Improving offshoring of low-budget agile software development using the dual-shore approach: an autoethnographic study

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Abstract. This paper examines how agile software development can be implemented in an offshore setting by introducing and testing the dual-shore approach. The topic is further enlightened by an analysis and discussion of an empirical autoethnographic study proposing three specific suggestions for improvements of a particular agile offshoring process. Furthermore, the discussion leads to a modification of the original dual-shore approach to fit the characteristics of low-budget development projects. The article explains agile development and elaborates the four basic principles associated with it. The four principles are then used as a framework throughout the article. A short introduction to the terms outsourcing and offshoring is given, and it is illuminated how agile processes can be implemented into offshored development. The most common difficulties regarding agile offshoring are described and the dual-shore model is introduced as a tool to improve communication in an agile offshore setting. A qualitative case is presented highlighting the methodological concepts. Key contributions are that the dual-shore model is suggested to be supplemented with Exemplary Business Process Models extended beyond the onshore team and partially presented to the offshore development team, the metaphorical layers of the dual-shore approach is specifically included, and a design of an online start-up meeting is proposed.

Keywords: Agile development, agile offshoring, dual-shore, software development, low-budget projects, Exemplary Business Process Models.

1 Introduction

Agile software development methods are becoming widely recommended practices in IT companies as well as object of widespread academic interest [41]. Using agile software development methods to produce software is quicker and customer specifications are used more iteratively. The agile development process is flexible and alleviates traditional development challenges [1] such as responding to change and customer collaboration [2]. Based upon the fact that developing software across borders is also becoming a major trend in the IT industry [3], there is a rather
extensive body of literature examining the effect that offshoring software development has on the agile development process [2][4][5].

The main focus of this article will be to review the theory - within the topic to gain an understanding of key parameters in successful agile offshoring software development. As a secondary agenda, the key project types discussed are small, low-budget development projects that have traditionally been difficult to bring into offshoring due to project management overhead cost. As agile methods in offshoring are not uncommon, this paper is aiming at understanding and improving the communication and knowledge transfer processes between the three involved parties.

The review of theory is divided into three sections. The first section deals with theory on the core concept of agile software development will be reviewed, bringing insight into agile software development in its traditional form. Next, to gain an understanding of the term offshoring and the possible pitfalls connected with this specific approach, literature on the topic is examined. These two sections of the theory review should act as a preliminary research leading to the third and final section, namely, as mentioned earlier, theory referring to the effects offshoring might have on agile software development and how to avoid these.

An autoethnographic methodology [6][7] is used to study processes of agile offshoring from the inside. The methodology encompasses establishing a company and engaging with customers and suppliers while maintaining a research perspective. By analysing the project executed, the theoretical insight is substantiated with continuously available empirical data.

The research purpose of this article is to clarify how offshoring agile software development could be performed using the four principles of agile development [8]. Furthermore, the purpose is to illustrate the theory by analysing an autoethnographic study reviewing how the dual-shore approach could improve the process, leading to a discussion of the practicality of the dual-shore approach in low-budget projects [9].

2 Literature Review

In the following, a literature review is being presented, starting with a description of classic agile development and followed by a clarification of offshoring and outsourcing. Then, a description of the issues in offshoring combined with agile development is executed. The literature review is concluded by introducing the dual-shore approach which includes solution-oriented tools in handling agile offshoring development.

2.1 Agile software development

The agile software development concept was originally introduced around year 2000 [10][41], but the fundamental research of agile or “disciplined problem development” [11] was notably introduced by Takuchi and Nonaka [12][13][14] who contemplated that factors such as low costs of delivery differed – and high-quality products were not enough to succeed in a competitive market. Instead, companies must deliver
products faster and with a higher flexibility. Today, this is one of the key justifications of agile product development [15].

Agile development differs from traditional methods and plan-based approaches. The plan-based approaches stick to the term that every part of the project can be carefully planned and specified before the actual development starts [16]. These methods are often used in larger and more critical projects running over several years, where room for specification changes is often not welcome. When developing smaller software projects using carefully planned project models, the time spent on overall system design is often higher than the time spent on the actual development [17]. Instead of focusing on system design, agile methods are targeted on producing software faster and making room for dynamic specification changes while developing (due to changes in user requirements). Agile methods are largely question of communication and learning [15] and knowledge management [41].

To better understand the principles of agile software development, the Agile Alliance [8] created a manifesto based on four different values described below [10].

1. **Individuals and interactions over processes and tools.** The point of these values is that individuals (e.g. programmers, testers and customers) and their way of interacting with each other is more important than having the right tools and processes, such as Gantt planning tools and stage gate development processes [18]. This does not mean that these processes and tools are unnecessary but having the right people working on the product is more important. Even though this sounds reasonable, it is still difficult to gain management acceptance to this methodological position based on desires to be independent of individuals, create legal documentation and generally maintain control [19].

2. **Working software over comprehensive documentation.** The main role of documenting software is to communicate the software between individuals (e.g. client and programmers), and strong documentation is therefore normally seen as a necessarily tool for producing software [20]. When the documentation is too comprehensive, like complex diagrams and technical specifications, focus is lost from creating quality software and creating documentation is becoming an objective of it own [10].

3. **Customer collaboration over contract negotiation.** Developing software in collaboration with a customer is often based on functional requests that the software development company subsequently translates into specifications used for development. But often the customer expressions are ambiguous, open-ended and with tacit connotations, and the expectation-perception is prone to change during the project period, effecting a change in specifications over time, which is difficult to specify in a contract. Instead the customer collaboration should be based on a contract containing a common understanding of everyone’s responsibilities and rights [10]. This is also the reason why many agile software development contracts are based on an hourly paid basis instead of at fixed price, which also creates trust and ties the customer closer to the development process [21].

4. **Responding to change over following a plan.** As mentioned above, requirements change during the project period which may be due to changes in the project stakeholders’ understanding of the project or changes in technology [10]. When operating in these changing environments, it is not possible to have fixed project management charts since, upon changes the management charts become
irrelevant or outdated; instead the planning should be flexible, dynamic and iterative [10][22].

Agile as well as structured methods have strengths and weaknesses. Estler et al. [42] show from their review of 66 projects no significant difference in outcome related to approach. However, subsequently it is assumed that smaller projects would match the agile approach better.

2.2 Offshoring and outsourcing

“Outsourcing is the use of external companies to perform services, rather than using internal staff” [2]. Offshoring is a variant of outsourcing where companies relocate business functions and structures to other and often low-wage countries [5]. According to the Danish government agency “Research and Innovation”, offshoring is the same as “outsourcing to another country” [23].

Motives for offshoring are primarily cost reductions. But benefits like increased flexibility, core business focus or employment of qualified staff can also be factors that drive offshoring [24]. Empirical studies have shown that offshoring also contains numerous problems such as geographical distance, time zones difference, cultural, social and political differences and other factors [5].

Furthermore, offshoring tasks related to geographically separated onshore and offshore teams are often very complex both due to the challenge of distance and multiple organisations, but also factors related to language, cultural and temporal differences have an influence on the complexity [5][25].

According to Kornstädt and Sauer [9], software development is one of the industries that experiences outsourcing of tasks to low-wage countries. It is stated that classic offshoring works best in stable environments where specifications are final and a piece of software is delivered. However, as described in the previous sections, many software development projects are too complex to be handled in this way [9], or too small to justify the overhead of thorough specifications.

To deal with projects of rapidly changing requirements, agile development approaches can be used to establish greater flexibility [5].

2.3 Offshoring and agile software development

Braithwaite and Joyce [26] define agile offshoring as: “an agile team is created at an appropriately low cost offshore location. Requirements are generated onshore, and communicated offshore using documents, people and tests.” Sauer [5] presents a framework that highlights the challenges regarding implementing agile offshoring. The challenges are classified according to the four agile values defined in section 2.1.

Working software over comprehensive documentation

Communication is the key issue when it comes to individuals and interaction [27][43]. Rooted in the offshoring projects geographically organised as distributed teams,
communication possibilities between teams are limited [26]. Problems that are easily solved in face-to-face meetings now have to be solved through telephone, videoconferences or chats. This is time-consuming and can be further complicated by difference in time zones and work rhythms [27][28].

As described, the distributed environment makes everyday communication difficult, which according to research decreases coordination efficiency and leads to less flexible processes. To cope with these challenges, publications propose that a team’s common knowledge is built up and maintained explicitly [5][43].

Customer collaboration over contract negotiation

Problems in this area can be regarding shared version controls. When teams do not work side by side, it is harder to generate a mutual perception of the progress in the development process [28]. Empirical studies also indicate that insufficient design capabilities of offshore developers can be a problem and that it is not easy to guide weaker or less experienced programmers over the long distances. Furthermore, different perceptions of adequate quality can also cause problems [5].

Responding to change over following a plan

The customer collaboration is obviously subjected to the same limitations in terms of geographical, cultural and time-zone differences as geographically distributed teams [29]. Therefore, a requirement analysis and frequent interactions with the customer can be problematic to perform. This can lead to a gap between the required specifications and the delivered application. Research also suggests that the establishment of a friendly atmosphere and credibility can be difficult [5].

Offshoring and agile software development

Because of the distance between team members, it can be difficult to keep an overview of the project progress and project management, and controlling is not easy. In addition, communication with developers regarding development costs and estimation can be negatively affected [30]. According to research, it is desired to establish knowledge transfer from onshore to offshore in order to involve the offshore team and make it achievable to ship as many task as possible offshore [5].

2.4 Dual-shore approach

Kornstädt and Sauer [9] present an approach for avoiding pitfalls in offshoring agile software development, called “The dual-shore approach”, which is basically an extension of the “Tools and Materials” (T&M) approach [31].

The term “dual-shore” is used to describe a certain type of development setting where development is carried out both onshore and offshore. The onshore team consists of local developers who deal with the business-related issues of development,
such as understanding customer needs and generating specifications. The offshore
team primarily focuses on the engineering of software and has no direct customer
interaction.

When software development is organised as offshoring, communication precision
is one of the main challenges [32]. The dual-shore approach takes this into account,
providing a set of methods for establishing common understanding of a project. It also
ensures agility in offshoring projects by applying practices like continuously adjusting
the development process through iterations and improving communication [33].

Figure 1 shows the most relevant processes in the dual-shore approach.

When a project has been initiated, onshore developers and offshore developers
work in parallel to each other. Onshore developers work as a mediator between the
customer and the offshore developers. They participate in iterations with both the
customer and the offshore team throughout the entire development process. This is
done to accommodate new or changed customer needs, and to pass this information
on to offshore developers without any misunderstandings.

The dual-shore approach presents different communication precision methods that
are important when trying to improve communication [26].

Metaphors, Exemplary Business Process Models (EBPMs), design and conceptual
patterns as well as sound software architecture are all methods that improve onshore
developers’ understanding of the customer’s environment and help the onshore
developers mediate between the customer and offshore developers [9].

Metaphors are used to develop a common understanding of the core concept
behind the software to be developed, both in the communication between onshore
developers and customers, and between onshore developers and offshore developers.
Metaphors work as a helpful resource when trying to pass on messages with a high
level of complexity, especially when communicating across borders. Metaphors are
split into two categories; Guiding metaphors and metaphors.

“For generic office applications, the guiding metaphor “Expert Workplace” is a
good fit: It is easy to envision Tools, Materials, Automatons (such as a calculator),
Containers (such as folders) and a Working Environment (such as a desk with in and

Metaphors are a layer on top of guiding metaphors and are used to elaborate the
guiding metaphor if necessary.

EBPMs [34] help onshore developers gain an understanding of how the customer
envisions the overall functionality of the software. An EBPM exemplifies everything
from what specific user interaction should result in to how and when certain processes
should be performed in the software and by whom.

When onshore and offshore developers communicate, design and conceptual
patterns are used as an additional layer on established metaphors.
The key elements of figure 1 contribute to a further and more detailed understanding of the software than the one obtained when explaining the core concept through metaphors alone. Where conceptual patterns state how the software behaves, the design patterns describe the interaction between different parts of the software. To communicate the software architecture is also of great importance. The software architecture is the blueprint of the development process, and helps developers maintain control in a complex system.

In short, the dual-shore approach is an offshoring setting that enables low development costs, agility in an offshoring development process and increases the success rate and quality in offshoring projects.

3 Research Design

The research design for the project of this paper uses Crotty’s [35] research matrix, starting by describing the philosophical worldview, followed by a research strategy and finally describing the research techniques.

The social constructivist’s philosophical worldview perspective is used throughout the project. This perspective is used as the research team believes that the consensus is not only created by the single individual, but also in a social context based on relevant social and cultural constructions [35][36].

The research strategy used in this project is based on an autoethnographic approach. Autoethnography is a variety of ethnography, meaning studying a cultural group over a certain time period, primarily done by observing and interviewing [37] with a strong role of the self of the researcher. The difference between these two approaches is that within the autoethnographic approach the research team is part of the object being researched [6]. By using the researcher’s perceptions and experiences as an important part of the construction in the researched field, the distance to hands-on data can be minimised. When using the research team as the researched object,
there are some pitfalls one of which is related to the fact that it can be difficult to step aside and make correct and unbiased observations [6]. The research employed the guidelines from [6][7][37] in order to minimise the bias. Three members of the author-team have created the entrepreneurship organisation that is the object of the study, and will be described further in the empirical section. All members basically had the same roles within the team however some division of work existed with (1) customer relations, (2) supplier relations, (3) technology/deliverable coordination.

A deductive approach [7][38] has been used because the goal of this project is to generate knowledge within offshoring agile software development based on a well-defined theoretical foundation. The data inquiry is based on the theoretical framework derived from the four agile principles. The empirical data is collected during the development of a smartphone application corresponding to two months, and are documented as narrative descriptions by having the research team interviewing each other [7]. Furthermore, reactions from the customer and the offshore development team were recorded, and finally “objective” data was included: Requirement specifications, database interface description, the document flow between the three parties, test reports, customer change requests and the developed software.

4 Empirical Work

Section 4.1 describes the setting of the empirical data collection and the application of the autoethnographic approach. Sections 4.2-4.5 follow the four agile principles in respect to relations and interaction.

4.1 Autoethnographic settings

APPbility is a small Danish software company with a total of four staff members. The company has specialised in the development of B2B mobile applications through offshoring of the software development to lower wage countries. APPbility has worked with suppliers from Serbia. This ethnographic study deals with a specific project regarding an iPhone application for a Danish customer. The purpose of the application was to replace the customer’s old manual laser scanners used in showrooms and on exhibitions with an iPhone application, creating different new possibilities for the customer in their business processes.

In the project, APPbility’s Danish engineers were located onshore doing requirement analysis, concept development, graphic design and customer collaboration, while all software development was carried out by the Serbian software team.

Before the project started, a collaboration agreement between the Serbian development company and APPbility was made. The collaboration agreement described general business terms, such as when and how payment should be made, and how specification changes should be handled.

The duration of the project was two months and at no point during the project did the onshore team or the customer meet the offshore developers physically. In total,
470 effective man-hours were used from the concept development to final delivery of
the product (as shown in the table below).

Table 1. Project hours

<table>
<thead>
<tr>
<th>Task</th>
<th>On-shore team hours</th>
<th>Off-shore team Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concept development</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Project planning</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Communication with off-shore team</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Communication with customer</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Coding</td>
<td></td>
<td>190</td>
</tr>
<tr>
<td>Testing</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td><strong>Sum</strong></td>
<td><strong>280</strong></td>
<td><strong>190</strong></td>
</tr>
</tbody>
</table>

Besides the role of being an intermediate in the process between developer and
customer, the setting is intended to be an experimental platform of organising
software offshoring, customer interaction and entrepreneurship. Projects are
continuously being closely monitored and reflected, and organisational learning is
critical.

4.2 Individuals and interactions over processes and tools

As described in the method section, the empirical observations are divided into the
four basic principles of agile software development. Subsequently, the handling of the
four agile principles throughout the project and how the APPbility staff experienced
the process will be presented.

Interactions between onshore and offshore team were done through Skype and
e-mail. Between 10 and 120 minutes Skype talking and chatting were conducted each
day. The communication with offshore developers was done exclusively by APPbility
staff and not the customer.

The dominant issue regarding individuals and interactions can be described as a
combination between geographical distance and language. As both the onshore and
offshore team had to speak a foreign language (English), difficulties in
communicating specifications and design requirements could arise, particularly during
the first two weeks where much information concerning the application specifications
needed to be transferred from the onshore team to the offshore team. In this
preliminary stage of the development process, the geographical distance became an
issue. It was not possible to explain details face-to-face which led to
misunderstandings, thus requiring extra work in communicating the purpose of the
application and its functionalities.

The cultural difference was not perceived as a barrier in general interaction. But
because of different religions in Denmark and Serbia, the Christmas holiday is
celebrated on different days in the two countries. As a result, some of the staff in
Serbia had to work during the holiday season in order to meet changed requirements
within a deadline.

The staff of APPbility did not experience that flexibility was affected by the
distance between the onshore and offshore developers. The developers’ constant
availability on Skype was stated as the main reason to answer questions quickly when needed.

4.3 Working software over comprehensive documentation

Before the Serbian development team started the software production, the onshore team made a set of documentation. The documentation consisted of two parts; a simple mock-up document showing visual depictions of the application along with a small description for each, and a document describing the links between the client’s existing server and the application in total about 15 pages. The creation of this documentation was very time-consuming, since every detail of the app needed to be communicated and illustrated. In line with Kornstädt and Sauers recommendations, a project specific style of EBPM was introduced from the dialogue between the customer and the onshore team to the offshore team. The EBPM had a propaedeutical character for the testing and learning purpose and is coarsely illustrated in figure 2.

Figure 2. Rich picture used as EBPM illustration

![Rich picture used as EBPM illustration](image)

When the software development started, the offshore developers used the simple visual mock-ups quite often, whereas the server description was hardly used due to the complexity. This caused the offshore team to ask questions through Skype and email, demanding much time spent on reinforcing the Serbian offshore team of the server settings.

Offshore developers started by delivering separate parts of the application. Onshore developers then tested these parts in collaboration with the customer and submitted feedback via emails and Skype calls to the offshore developer.

The staff of APPbility and the offshore team relatively quickly gained a mutual understanding of quality and project progress. They even experienced offshore staff suggested improvements and tried to refine the application within the given boundaries.
4.4 Customer collaboration over contract negotiation

As stated earlier, the customer and the offshore developers did not interact. Collaboration between the customer and onshore developers was done through telephone calls and face-to-face meetings. When starting the project, an initial frame of specifications was created and a price was estimated. A contract containing the agreed initial specifications and a fixed price was signed.

Throughout the project, only three face-to-face meeting were held. The frequency of the telephone calls was three calls a week at the beginning of the project and only once a week after that. At the end of the project, testing of the application had to be conducted, which again caused the frequency of telephone calls to be three times a week.

The staff involved described the customer collaboration as being very good and flexible.

4.5 Responding to change over following a plan

It was agreed with the customer that when new specification demands evolved during the project, the customer would pay for the extra hours needed. Smaller changes with the already given specifications were included in the contract’s fixed price.

All tasks regarding cost estimation were done offshore. Subsequently, information on cost estimation of changes had to be adjusted between the offshore and the onshore teams as well as communicated further by the onshore team to the customer for approval.

5 Discussion

The literature review provided knowledge about typical challenges in offshoring of agile software development and how to avoid these using the dual-shore approach [9]. This section will be used to discuss what processes the company from the autoethnographic study should maintain to ensure successful agile offshoring in the future. In the following, a set of suggestions for improvement of agile offshoring of software development will be developed. Subsequently, a revised dual-shore model for use in similar software development projects aiming at low-cost agile offshoring is presented, and finally, the credibility of the findings will be discussed according to the limitations of this article.

5.1 Processes to maintain

In a process perspective on the described project, interaction is a dominant issue. Interaction requires careful scheduling and rescheduling on an ongoing basis to ensure the appropriate flow of information and associated filtering as well as approval processes. Interaction is also a cost factor for the customer, the onshore team and the offshore team – a cost factor both in time spent to exchange information illuminating the assignment, but also interaction to avoid errors.
Frequent iterations. As described in the literature review [4], frequent communication and feedback loops are vital to avoid misunderstandings and ensure an agile development process. The empirical data from this study also shows that frequent and adapted communication is a major precondition for a flexible and well-coordinated offshoring project. The frequent communication between onshore and offshore developers should therefore be maintained in future projects to ensure an agile process [43]. The frequency of scheduled interaction is at best changed dynamically with varying number of calls per day/week. Unscheduled interaction, e.g. chatting, can be valuable in the fine adjustment of information, and is generally less costly.

Customer collaboration and testing. Theory states that a gap between customer expectations and delivered software can arise due to the distance between customer and developers. In the autoethnographic study, small parts of the application were delivered to onshore developers and tested in collaboration with the customer. In combination with short feedback loops, this ensured that the overall development constantly moved in the right direction and a gap therefore did not occur. The partial “micro” delivery, the immediate test possibilities, the organisation of the onshore team close to the customer are key factors in the model perspective of avoiding the misdelivery gap, keeping rework and post-development testing costs down.

5.2 Suggestions for improvements

By using the dual-shore approach, three specific improvement suggestions for APPbility’s agile offshoring process are presented. Where the development organisation is in the middle and has close access to the customer, the offshore team is distant; the suggestions aim for communication, vision & knowledge sharing and collaboration between the offshore and onshore teams to reduce misinterpretations. The following enlightens how the dual-shore approach can be used in practice to improve specific offshoring projects. Finally, the model is revised for use in future agile offshoring projects similar to the autoethnographic study.

1. EBPMs. It is suggested that the development onshore team should benefit from a more effective use of EBPMs (Exemplary Business Process Models) when mediating between the customer and the offshore team. The autoethnographic study points to troubles in passing on information about the software specifications and architecture to the offshore team. By creation of EBPMs from initial specification iterations with the customer, these EBPMs should be forwarded to the offshore team, providing them with a more illustrative understanding of the software to be developed. In this way, the onshore team and offshore developers can avoid relying on the English language as the only means of creating a common frame of reference. EBPM stripped of direct customer references, but maintaining it representational form, is suggested to make interaction/communication more precise and effective. This is illustrated in figure 3 as bringing EBPM closer to the offshore team but with omission of key customer data.
2. **Metaphors and patterns.** The communication between onshore and offshore developers in the specific case was frequent but not precise. To improve communication between all parties of the project the dual-shore model suggests using metaphors, guiding metaphors, conceptual patterns and design patterns. By using these tools, onshore developers can communicate specifications and changes more efficiently to offshore developers.

3. **Online start-up meeting.** APPbility staff expressed communication of the basic project features and specifications to offshore developers as a problem.

   The dual-shore approach suggests that the onshore and offshore developers start out by meeting physically, and the project is presented by the onshore developers. The offshore developers will return to their home country with a frame of reference common to onshore developers and the customers. However, this solution is considered relatively expensive for small and low-budget software development. Instead, it is suggested that the start-up meeting is conducted online using video calls and file sharing services. Using experimental forms of online interaction and social confrontations in line with the general momentum of virtual social interactions known from social media and virtual communities of practice [39][40][43].

   If the communication relies on EBPMs and the communication tools described in the dual-shore model, it is assessed as possible to establish a common frame of reference through an online meeting. Communication of the basic project features is followingly done efficiently, accurately and without any traveling cost. Establishment of an online social context is in line with [5][4][27] but more emergent and balance the interpersonality with the product-centric exchange of perceptions and positions.

5.3 **Project coherency**

The purpose of this paper has been to extend the understanding of the applicability of the dual-shore method to overcome onshore-offshore communication discrepancies.
and make offshoring more successful in low-budget development. A secondary purpose of this paper has been to apply the autoethnographic approach to the offshoring process. This was done by creating a company and engaging the group of authors in the experimentally inspired process improvement with the company. The research-supported practice orientation strongly supports the process of learning of offshoring of agile software development. In this way, the actor self of the autoethnography incites constant reflection on the actual project level and, in particular, on the process improvement level. In this view, the suggestions and findings should be sensible in similar contexts with appropriate reservations for differences of project complexity and maturity of the three parties.

6 Conclusions and suggestions for further work

This study has shown distinct patterns in optimising agile software development in an offshore setting. In addition, it has elaborated the possible pitfalls in this process and introduced the dual-shore approach for management of critical challenges. Furthermore, this article has highlighted the topic by analysing and discussing an autoethnographic methodology distinctively aimed at testing offshoring methodologies and subsequent learning. In addition, the paper has shown how to apply the theory and the dual-shore approach in practice by proposing three specific suggestions for improvements in the ethnographic case study, and describing how to refine the dual-shore model to fit future low-budget agile offshoring software development projects. We conclude that the extended sharing of information as explaining in suggestion 1 on EBPM together with knowledge elements of suggestion 2 and the organisational processes of suggestion 3 together forms a more efficient process without sacrificing the advantages of the agile approach.

Future work is related to implementing the suggested tools from the dual-shore approach into new offshoring projects for APPbility as well as to investigate if the suggestions from the discussion section lead to expected improvements. Furthermore, the company is testing the revised dual-shore approach on other offshoring projects with different contestants.

The findings of this article are the result of the focus imposed on the literature research. The theory found and used in this article revolves around common challenges affecting offshoring of agile software development. However, theory about rare but extensive challenges could also have been reviewed giving a more in-depth overview of what to be aware of.

The dual-shore approach has been used as a solution to common challenges in agile offshoring projects and as a test of Kornstädt and Sauer’s [9] suggestions. However, the theory of this article does not cover other possible tools/methods for overcoming these difficulties. Better and more versatile approaches that could be helpful in overcoming mentioned difficulties might be available.

Moreover, the study does not contain the view of the customer nor the offshore developer which is an important source of error. It contributes to the problem of the autoethnographic study where the researchers are also the researched object and can be biased because of their involvement in the project.
Furthermore, the autoethnographic study is not supplemented with other studies to support its validation and make it applicable on a broader range of practices. The philosophical world view of this article may result in certain conclusions and preclude others. It can therefore not be excluded that another world view could have led to other findings in this study.

References

Youth-elderly and digital use

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Abstract. Sometimes things are taken for granted. If people in general, and elderly people in particular are asked, they might have different views of what they need, demand and are interested in when it comes to services produced with computers and mobile devices, as compared to what the industry offers and assumes that they want, need and value. When Information Systems (IS) are designed it is important that they are developed in accordance with their target group. This explorative study investigates how the group known as young-elderly (60 – 75 years of age) in Sweden perceives services on the Internet and what is required in order to capture their interest. This study indicates that it is vital to build a servicescape in coherence with the customers’ demands, needs and interests as well as to establish credibility in order to gain their trust.

Keywords: Information System (IS), Marketing, Servicescape, Service, Trust, Credibility.

1 Introduction
All people, young or old, wish to have a good life. Today people are living longer and are healthier even at advanced ages, which is something that at times is taken for granted. However, the fact that people are living longer brings about new problems, which is something we will address in this paper. We argue that a combination of skills, including marketing, understanding the customer and tailor-made digital services can create opportunities to help solve these problems.

1.1 Aging, Marketing and Digital Services
We – the authors – are lecturers in marketing and we have backgrounds as practitioners in marketing and doing business. As lecturers, as well as practitioners, we have noticed and experienced that there seems to be a gap between what is offered from the IS-industry and what we perceive that older people in particular need, demand and value. In this paper, and in a second paper [1] with focus groups, we argue that digital use can play an important role in addressing the above mentioned problems and therefore there is a need to understand the way in which the young-
elderly group uses and behaves on the Internet as well as their usage of digital services on computers and mobile devices.

Not long ago the conventional image of people's average expected lifetime in Sweden appeared in the form of an age pyramid, one which at its apex, pointed out that few individuals were expected to live past 80 years. Today, the pyramid has been replaced by a figure (Fig. 1) more reminiscent of an, admittedly slightly uneven rectangle, where there has been a shift up, as many people are expected to approach or even pass the age of 100 [2].

The United Nations Population Fund (UNFPA) [3] argues that the group known as young-elderly (60 – 75 years of age) is getting larger and larger, not only in the western world but worldwide. For the individuals themselves, for their families and for the society, the rapid growth of this group creates demands and needs which must be dealt with, not in the future, but already today.

We have noticed on the Internet, in newspapers and in TV commercials, for example, that various companies try to persuade people to download apps to their computers and mobile devices. The argument used by the marketers often describes what the digital service can do for the customer and that it is shaped to facilitate the customer’s life. However, what we will discuss in this paper is that not everyone pays attention to the digital services offered.

1.2 Purpose of the Study

The purpose of this study is to search for a pattern in the digital services used by the young-elderly on devices such as computers, mobile phones, smartphones and tablets. Our aim is to analyze the group of young-elderly who are retired or will soon retire, with a focus on their relationship to digital services and their response to what the industry offers. To fulfill this we will give an insight into what services they use often, seldom or not at all on the Internet and thereby create an understanding of what digital services can be developed that are suited for the target group of young-elderly people and that help them in their daily lives. We also aim to show whether or not
young-elderly are interested in sharing knowledge and making use of others’ digital service knowledge. This study will be one step in a series of steps toward understanding the demands and needs of the young-elderly and thereby will hopefully give some insightful thoughts to the IS-industry and others who might be interested.

1.3 Research Question and Structure of this Paper

The research question is:

- What is required to capture the attention of the young-elderly and to get them interested in the use of digital services?

This paper will be structured as follows: Section 2: Background. Section 3: Study and methodology. Section 4: Literature review. Section 5: Findings. Section 6: Discussion. 7: Conclusions.

2 Ageing in the Internet era

Through their organization the UNFPA, the United Nations (UN) has conducted a study about worldwide ageing and argues that [3, p.12] population ageing is one of the most significant trends of the 21st century. The UNFPA continues by claiming Population ageing is happening in all regions and in all countries at various levels of development. The UNFPA [3, p.12] claims that population ageing also presents social, economic and cultural challenges to individuals, families, societies and the global community. The UNFPA (Fig. 2) states that in 1950 there were 205 million people in the world who were 60 years of age or older and in 2012 that figure has increased to 810 million. The forecast indicates the figure will be one billion in about 10 years’ time and that the number will double by 2050. The extent of all these people will create large demands and challenges for society and for people’s way of living.

![Fig. 2. Number of people aged 60 or over (UNFPA- Ageing in the Twenty-First Century: A Celebration and A Challenge, 2012)](image-url)

\[\text{Number of people aged 60 or over: World, developed and developing countries, 1950-2050}\]
What the UNFPA argues is evidenced by what Statistics Sweden (SCB) [2] found in their research of Sweden's population structure changes from 1850 to date, which also presents a forecast for the coming years until 2050. The report indicates that people are more and more likely to live longer. According to SCB’s population forecast, the average age of a person at the time of their death will be 90 years or older around the year 2060. SCB estimates that half of those who are born today will reach the age of 92. It should also be added that in addition to people living longer, the research indicates that the number of children born per woman in a number of countries in Europe is between 1.3 and 2.0 [4]. According to Statistics Sweden's [2] latest population estimation from 2009, the total population in Sweden will increase from today’s 9.5 million to 10.7 million in 2030 and 11.6 million in 2060 (Fig. 3).

If the proportion of the population who are gainfully employed remains at today's level, it is expected that the workforce between the ages 16-74 will amount to just over 4.5 million by 2030. This is an increase of over 140,000 persons compared to 2010. Each income earner will have to earn for 2.35 people including him- or herself compared to 2.14 persons in 2010. SKL, the Swedish Association of Local Authorities and Regions, has calculated what the costs of welfare services will be in Sweden in year 2030. They state that with today’s system of financing, there will be a gap between the need of public services and public resources, which means that taxes will have to be increased by 13 SEK [2]. To minimize the burden of the welfare system’s costs per capita, more people have to work more years and retire from work at a higher age. To maintain the current dependency ratio in the year 2030 would require that at least 600,000 more people were gainfully employed than are today [2]. SCB has also stated that if people work longer, that is to say, retire at an older age, it will have a huge effect on decreasing the burden. SCB describes that the employment rate drops sharply at the age of 60. As mentioned before the group of people who are 65 years and older is expected to grow significantly and they will represent an even
larger part of the total population, therefore it is important that more people work longer, beyond 65 years of age. This is possible to achieve by improved health and well-being further up the age curve.

Fig. 4. Dependence of years worked 1990-2030. [2]

Fig. 4 shows that a reduction of the dependence of individuals is possible if more people work longer. In early 2012, Sweden’s Prime Minister, Fredrik Reinfeldt claimed that in the not too distant future, Swedes will have to, on average, work to the age of 75 to maintain the Swedish level of welfare [5]. The Prime Minister continued on the 6th of March 2013 by suggesting a lower income tax for people over 63 years of age if they continue working [6].

From our perspective, in the Internet era the group of young-elderly is at the intersection between people who are familiar with using digital services and those who have little or no experience in doing so. The habits that this group acquires will stay with them as they continue to age and create the conditions for a higher quality of life.

3 Study and Method

The respondent groups were members of three different networks. This study is comprised of three surveys with 32 respondents in the first group, 15 in the second and 16 in the third group which gives a total of 63 respondents. The focus and target of the study is the group of young-elderly. The members of the groups had, as far as we know, no connection to members of the other groups. The first group was mostly retired people who bowl together weekly. We got in contact with the group through a member who was able to give us access. The second and third groups contained two different groups of retired people who play boule together. We got access to the two groups through personal contacts. The reason for focusing on these groups was to find young-elderly who are still physically and mentally active. We are aware that this way of selecting respondents has its limitations as the number of respondents is small.
and not all young-elderly are active people. Therefore these three groups cannot be seen as representative for all young-elderly. On the other hand there is an advantage to having a personal connection to the groups as they are more willing to answer the questions and do so in an honest way. Some of them made it very clear that they never answer questionnaires otherwise.

In the three surveys we first asked the respondents to answer some basic questions about their sex, age, marital status, occupation, if they were retired or still working and their level of education. The purpose was to give us a picture of the respondents. The next questions focused on if they have computers and mobile devices and if they answered yes, we then asked them what Internet-services they use. We continued by asking them if they are interested in making use of others’ knowledge respectively sharing their knowledge with others through Internet services. Finally we asked the respondents if there was anything they wanted to add or suggest.

Our research was made as an explorative process. Explorative research is designed to observe, describe and document and this involves collection of data to provide a sample and description of individuals, groups and their behaviour [7]. First we made a pilot questionnaire and tested it with colleagues which indicated that some minor adjustments had to be done. Bell and Opie [8] claim that a researcher must be prepared for that things do not always go the way they are intended to go and therefore a pilot study can help the researcher to sharpen the main study. The first survey consisted of 32 respondents. After its completion we made some minor changes to the questionnaire as we noticed that some answers inspired additional questions and a few questions gave us information of little or no use and could therefore be excluded. A few questions were also changed based on the fact that we realized that the respondents were a bit unsure about what we were asking.

In the study we mainly used closed questions. According to Bell and Opie [8] closed questions are those which give the respondents a limit of possible answers. The respondents had to tick in a box for the answer in line with their opinion. The last question was an open question as the respondents were given the opportunity to offer suggestions. Bell and Opie [8] explain that open questions are a form of question where the respondent is free to write their own thoughts and suggestions.

The study was performed by a descriptive method. Bell and Opie [8] explain a descriptive method as one that works with collected data and characteristics of a population to find patterns and thereby to find and explain phenomena.

Bryman [7] explains that while working with research it is of great importance that everything is done to reach a high level of reliability and validity. Reliability is about trust in the way the research is constructed and performed. This means that if the research is done a second time it should produce the same results. Validity on the other hand is focused on whether or not the researcher is measuring what is intended to be measured. According to Fowler Jr. [9] the quality of the sample in a study depends on the size, frame and design of the selection procedures. In the study we have been careful during the operationalization of our research questionnaire in order to reach a high level of validity. We have spoken with young-elderly in our families, among our friends and in our network and have also followed recent media discussions. Our credibility was granted by our contacts which led to high participation and small internal fall-off. Hence we consider our research findings reliable and valid. But at the same time we are aware of the small number of
respondents and that our means of selection has its limitations. Hence the results only represent these particular young-elderly and it is therefore important to use caution when generalizing. A lot more research has to be carried out in order to make the results valid and reliable for the population of young-elderly.

4 Literature Review

In this section we present the literature review. We will start by presenting IS (4.1) and continue with marketing (4.2).

4.1 Information system

Alter [10] divides IS into three main parts; Information, People and Information Technology. These three work together in various combinations. Information can include a variety of formatted data, images, text and sounds. The work by IS can be automated but in the background there are always people working with and in the system and therefore in one way or another affecting the system. Information technology includes hardware and software. Alter [10, p.9] claims that consequently, understanding information technology is not equivalent to understanding information systems. Alter [10] claims that people developing IS do not automatically know what the target group needs, wants and values. The author argues that sometimes there is a dichotomy between the developer and the group at which the IS are aimed, and therefore there is a risk that the system will not meet the needs and interests of the target customer. Langefors [11] claims that it is important to pay attention to the human side and therefore people (users) have to be involved in the IS development process. Galliers [12] states that it is important to consider that human beings gather information in order to make decisions and that mobile devices can support decision making. Therefore IS must be designed with the target user in mind and make sense to them. Galliers [13] claim that IS are more or less business systems and therefore have to be dealt with as such. If they are not designed in accordance with the customers’ demands, the customers will become reluctant to use them. Markus [14] claims that people adopt IS for the benefits they perceive as useful to them. Halonen and Thomander [15] suggest three main parts for making IS successful:

- System Design, includes System Quality, meaning is it easy-to-use and user friendly, Information Quality, which has to do with whether or not it’s useful and up-to-date, and, Service Quality, which focuses on the interaction and has to do with availability, fairness and understanding.
- System delivery includes Use and User Satisfaction where Use concerns, for example, density and timetable, and User Satisfaction has to do with overall satisfaction and how enjoyable the experience is.
- System Outcome has to do with Net Benefits and includes both Positive Aspects like benefits to studies and Negative Aspects like self-guidance.
Bouwman et al. [16] claim that the composition of service is of great importance and that there has to be positive attitudes for innovations in the mobile services industry to meet the demands and needs of the customer. Keen and Mackintosh [17] discuss that value of applications in mobile phones is that they generate a freedom for the consumer. Value, in the form of freedom, means that the customer is not limited by time and space, but rather is able to get information about products and shop whenever and wherever they want. This is a digital service that few physical stores can offer. At the same time, it is important to be aware that people are not always willing to change their habits and to adopt new technologies, something which is discussed by Carlsson [18, p. 189] who claims that:

**In summary, past history shows that advances in mobile technology can enable the deployment of new services but are in no way guarantees that these services will be broadly adopted. Indeed, as discussed in one of our earlier studies, consumers have often proved reluctant to adopt new services – however fancy the underlying technology might be.**

Keen and Mackintosh [17] argue that it is close to impossible to over-hype the power and potential of m-commerce and wireless shopping. They continue by claiming m-commerce is the next step towards “the freedom economy” as the customers can buy, sell and swap products at any time. Keen and Williams [20] pinpoint the solution by recommending that innovators are always updated on the value changes of the market and put effort into the changes that can make a powerful impact and thereby gain advantage on the market. Rivard and Lapointe [21] claim that it is important to establish the credibility of the message being sent as well as the source of that message. This means that credibility and trust are important in the servicescape since if there is a lack of trust, the customers will reject the digital services offered. Papadopoulo et al. [22] discuss trust in e-commerce and they connect trust to relationship marketing and the servicescape and claim that virtual reality technologies can effectively be useful to shape an e-commerce environment.

### 4.2 Marketing

Over the years, marketing has been developed, changed and discussed from different perspectives. A lot of attention has been paid to the classic 4P-model, Product, Price, Place and Promotion while at the same time consumer behavior has received a great deal of interest. An area that subsequently received more and more noteworthy attention is Service Management, where over the years theories with a focus on services and trade have been developed. In the Service Management discourse the delivery of service and service processes has also been in focus. Grönroos [23], [24] stresses the importance of a service oriented approach and that the interaction between the customer and the service provider as well as quality and productivity is of great interest. Bitner [25] introduced the Servicescape concept and he defines it as the environment in which the service is brought together and provided and in which
the provider and customer interact, combined with tangible commodities that facilitate performance or communication of the service. Nowadays virtual IS can be added to the servicescape discourse. Mummalaneni [26, p.526] describes the virtual servicescape as the environment of the virtual storefronts created through Web page design is not unlike the atmosphere of the brick-and-mortar stores with their emphasis on layout, merchandise-displays, lighting, signage and so on. Vilnai-Yavetz and Rafaeli [27] refer to the aforementioned Mummalaneni and state that an e-service setting can be labeled as a virtual servicescape and will influence the perceptions and feelings of the customer.

Kotler [28] argues about the combination of shopping atmosphere and purchase behavior in which the author discusses how people’s senses have an impact on purchasing decisions. Kotler [29] returned 38 years later, to what he wrote in 1973, where he, together with Ravi S. Achrol, discusses the importance of the senses in conjunction with marketing. In the article, Kotler and Achrol [29] discuss something that was not possible for Kotler to address in 1973, which is the Internet. Achrol and Kotler [29, p.38] state:

Those of us who grew up in the physical world cannot begin to imagine life as it will be for those who grow up in a digital world. The digital world will offer nearly endless possibilities of shaping life and experiences so that the physical world will pale in significance and may well become a secondary world in which our bodies live wired to a digital reality.

Ezeh and Harris [30] discuss service and servicescape and argue that the servicescape is important to a service organization and can also be seen as a determinant for the customers as well as the employees. The authors continue by claiming that the design is crucial for a successful servicescape. In a study, Harris and Ezeh [31] point out four variables they claim are important for the servicescape (Fig. 5).

![Fig. 5. A conceptual model of servicescape](image)

The variables are ambient conditions, design factors, staff behavior and staff image. These variables affect what the authors describe as loyalty intentions which, although
less strongly, will be influenced by personal factors and environmental factors. The authors [31, p. 410], referring to the model they developed (Fig. 5), argue that:

*All the moderators in the conceptual model were found to be strong facilitators of relationships in the servicescape. Therefore, service managers should take these into consideration when designing the servicescape and implementing the overall marketing function.*

Gumesson [31] claims that it is important to understand the interaction between the service provider and the customer. The interface will be an important part of the servicescape and therefore of great interest for the provider as well as the customer. They will meet in the interaction where the customer will play an important role, irrespective of if the interaction is performed face-to-face, ear-to-ear, e-mail-to-e-mail or by a customer-facing website. Often the services that the provider offers will be produced and delivered more or less at the same time the customer consumes them. Gumesson [31] continues by saying that the networks’ role in marketing is clearly underrated. He claims that a practitioner who wants to be prosperous will have to realize the importance of building networks and that marketing is performed and can be seen everywhere in the society. In networks, people share experiences of shopping and service through what is called word of mouth. Consumption has turned out to be a way of living, and technology must be in accordance with the demands and needs of the consumers.

In the service discourse, many authors [20], [23], [24], [29], [32], [34] point out the importance of the customers’ role in the process of creating value for the customer. Customer participation constitutes a resource that is reflected in the creation of the service but is also reflected in the fact that the customer interacts within his or her network and thus is also an important marketing channel. Lusch and Vargo [34] argue that there are two important parts of service. The first is, activities, and the second is, functions, and these have to be shaped in a way that attracts and adds value to the user. This way of thinking is underlined by Bouwman et al. [35] who state the idea that mobile service is not just about communicating and being able to be contacted anytime, anywhere. Furthermore the value of the service is of importance. Edvardsson et al. [36] claim that service providers, in their work with the servicescape, have to integrate the customer and move from creating for, to creating with and creating by the user. By integrating the customer it is thereby possible to strengthen the credibility and trust in the service and servicescape. Given that the customer is prepared to share knowledge, Tissen et al. [37, p. 192] argue “…everybody wants to get knowledge out, but nobody wants to put knowledge in” and Wu [38, p. 50] claims that “First, the conduct of the knowledge sharing necessarily involves the interaction of knowledge sharers and learners/.../Secondly, knowledge sharing is a type of social exchange behavior and one purpose of knowledge sharing is to gain knowledge from a current knowledge receiver in the future.” Sharing knowledge is not an easy task to deal with as it cannot be taken for granted that people are prepared to share. As Hislop states, there is a risk with knowledge sharing as a person who is prepared to share might get nothing in return.
5 Findings

This section describes the findings of our study based on the three surveys we conducted. Table 1 shows demographic information for each group, for example of the 63 respondents, 23 (37%) were female. The majority of the respondents, 54 (86%) were between the ages of 60 and 74, and the others were 75 years or older. Over half, 36 (57%) were married. 25 (39%) had finished primary school and 11 (18%) hold a university degree. Of the 63 respondents 52 (83%) had retired from working.

Table 1: Overview over the respondents

<table>
<thead>
<tr>
<th>Questionnaire</th>
<th>Number of respondents</th>
<th>Sex</th>
<th>Age</th>
<th>Marital status</th>
<th>Level of education</th>
<th>Working</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Woman</td>
<td>Man</td>
<td>60-64</td>
<td>65-69</td>
<td>70-74</td>
</tr>
<tr>
<td>1</td>
<td>32</td>
<td>9</td>
<td>23</td>
<td>0</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
<td>6</td>
<td>9</td>
<td>4</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>16</td>
<td>8</td>
<td>8</td>
<td>0</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>63</td>
<td>23</td>
<td>40</td>
<td>4</td>
<td>25</td>
<td>25</td>
</tr>
</tbody>
</table>

As shown in Table 2, among the 63 respondents 52 (83%) have a computer, 50 (79%), a mobile phone, 16 (25%), a smartphone and 6 (10%) have a tablet.

Table 2: Respondents level of equipment

<table>
<thead>
<tr>
<th>Questionnaire</th>
<th>Number of respondents</th>
<th>Computer</th>
<th>Mobile phone</th>
<th>Smartphone</th>
<th>Pad</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>32</td>
<td>24</td>
<td>26</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
<td>13</td>
<td>10</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>16</td>
<td>15</td>
<td>14</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>63</td>
<td>52</td>
<td>50</td>
<td>16</td>
<td>6</td>
</tr>
</tbody>
</table>

Finally we asked the respondents if there was anything they wanted to add or suggest. Of the few who responded, one added a wish for simpler digital techniques, a second expressed an interest in services dealing with genealogy and a third had to do with services like Skype in terms of getting in contact with doctors and medical services.

Based on the study we can conclude that there are negligible differences in the answers between them. The answers point in the same direction but that does not mean that the results speak for all young-elderly. Instead we want to state that the results only speak for these groups.
5.1 Use of Internet service

In terms of Internet use, the results (Table 3) showed that of the 60 respondents who answered the question, a majority, 51 (85%) use the Internet and that 9 (14%) never use the Internet. The Internet service usage of the respondents showed that of the 63 respondents, 48 (76%) use the Internet to send and receive e-mail, 39 (62%) for activities in societies and associations (e.g. Bowling club, Boule club), 32 (51%) for news pages (e.g. CNN, BBC), 28 (44%) for information sites (e.g. Weather forecast), 27 (43%) for travel services (e.g. Ticket, SAS), 13 (21%) for health and medical care (e.g. Sensia), 12 (19%) for activities on social media (e.g. Facebook), and 11 (17%) for buy-, sell- and swap-sites (e.g. EBAY) as well as for service at home (e.g. Homecare) and 10 (16%) for planner (e.g. TimeEdit). Finally, in surveys 2 and 3 a total of 22 (71%) out of 31 answered that they use the Internet for bank service.

Table 3: Overview over the respondents’ use of Internet

<table>
<thead>
<tr>
<th>Questionnaire</th>
<th>Number of respondents</th>
<th>Use Internet</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Email</td>
<td>Activitaet in assoc.</td>
</tr>
<tr>
<td>1</td>
<td>32</td>
<td>23</td>
<td>17</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>3</td>
<td>16</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>63</td>
<td>48</td>
<td>39</td>
</tr>
</tbody>
</table>

(Note: Bank service only in survey 2 and 3)

5.2 Making use of and sharing knowledge

Table 4 shows the results of the questions regarding Internet service and whether or not the respondents were interested in; i) making use of others’ knowledge, ii) sharing their own knowledge with others. The subjects asked about were; exchange of professional skills, traveling, physical training, personal trainer, augmented memory, betting, games, health advice, medical service, safety service, technical support, legal service, employment service, relationship counselling, person matching, education, genealogy and finally planner. In accordance with what the first group suggested, the category bank services, was added to the second and third questionnaire. For each of the questions the respondents could choose between the answers: not at all interested, a little interested and very interested. Based on the questions to do with at what level the respondents were prepared to make use of and share knowledge with others, the study indicates that many of them were not at all interested in sharing knowledge with others when it comes to physical training, personal trainer, augmented memory, betting, health advice, medical services, safety services, technical support, employment services, relationship counselling, person matching, education, bank and genealogy. A few were a little interested and none, or very few were very interested in sharing knowledge with others about the given subjects. There are some
areas where the respondents were a little more prepared to share their knowledge with others and those were professional skills, where 48% were a little interested in sharing, and traveling, where 56% were a little interested in sharing. Few respondents were very interested in sharing their knowledge with others. There are minor differences in most of the areas, but a pattern is revealed that shows that respondents are more interested in making use of knowledge than in sharing their own knowledge with others. Slightly more interest was shown by the respondents in areas like travel, bank services, medical care and technical support.

Table 4: Making use of and sharing knowledge

<table>
<thead>
<tr>
<th></th>
<th>Make use of others</th>
<th>Share to others</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Questionnaire</td>
<td>Questionnaire</td>
</tr>
<tr>
<td>Number of respondents</td>
<td>32 15 16 63</td>
<td>32 15 16 63</td>
</tr>
<tr>
<td>Professional skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not</td>
<td>10 4 5 19</td>
<td>8 7 2 17</td>
</tr>
<tr>
<td>Little</td>
<td>11 5 4 20</td>
<td>11 5 4 20</td>
</tr>
<tr>
<td>Much</td>
<td>1 3 1 5</td>
<td>1 1 1 3</td>
</tr>
<tr>
<td>Bank service</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not</td>
<td>0 0 0 0</td>
<td>10 2 12</td>
</tr>
<tr>
<td>Little</td>
<td>11 5 16</td>
<td>3 5 8</td>
</tr>
<tr>
<td>Much</td>
<td>2 7 9 0</td>
<td>0 0 0</td>
</tr>
<tr>
<td>Travel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not</td>
<td>9 0 3 12</td>
<td>9 7 2 18</td>
</tr>
<tr>
<td>Little</td>
<td>5 10 5 24</td>
<td>8 5 4 17</td>
</tr>
<tr>
<td>Much</td>
<td>3 3 5 11</td>
<td>2 1 4 7</td>
</tr>
<tr>
<td>Training</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not</td>
<td>10 9 5 24</td>
<td>10 12 5 27</td>
</tr>
<tr>
<td>Little</td>
<td>12 3 5 20</td>
<td>8 1 1 10</td>
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6 Discussion

On the Internet and on mobile devices there are a lot of different digital services aimed at attracting and adding value to people. But have the systems been designed with an understanding of the target group? Sometimes we doubt it. This study indicates that the young-elderly in general have the equipment for being an interesting group for the IS-industry. This study also shows that 43 of 63 (68%) respondents use the Internet at least once a week (Table 3). The six main areas for which the respondents use the Internet are bank service, e-mail, activities in associations, news service, information service and travel service. This indicates the areas of interest. Langefors [11] and Alter [10] discuss this issue and point out the dichotomy between the people developing the digital services and the target customer. Galliers [12], [13] and Markus [14] state that the human being has to be considered when developing IS. Therefore we claim that when designing IS, the starting point must be an attempt to understand the target group – in this case the young-elderly. When the first step is achieved the next step is to develop IS suitable for the target group. The third step will be to meet the challenge of persuading the group to try the services and to thereafter become a
frequent user. From a marketers point of view the customer meets a servicescape when they are surfing on the Internet regardless of which kind of digital device they use. In accordance with what many authors [20, 23, 24, 25, 27, 28, 29, 30, 31, 32, 33, 34] argue, it is of great importance that the service and the servicescape are designed to meet the demands of the targeted group. But it is not only about developing service and servicescapes in line with the demands and needs of the customer, but also, as Rivard and Lapointe [21], Papadopoulou et al. [22], Mummalaneni [26], Keen and Mackintosh [17,] and, Keen and Williams [19] claim, it is about establishing credibility and trust. It does not matter how well the systems are designed if there is a lack of trust in what the service provider and the servicescape offers.

When servicescapes are developed the designers want them to be attractive for the targeted group. However attraction without values will be of little or no interest to the target group. Therefore designers have to consider what Grönoos [23], [24] and Edvardsson [36] argue about interaction and co-operation and what Harris and Ezeh [30] describe with their variables and factors for building customer loyalty. Lusch and Vargo’s [34] two parts, activities and functions, are also to be considered when service and servicescape are developed. Bouwman et al. [16], [35] state that the composition of service in mobile devices is of great importance and Carlsson et al. [18] state that it doesn’t matter how well and elegantly the technology is made if the customer cannot comprehend its value and how it can benefit them. Our findings indicate that there is a lot interest in making use of others’ knowledge in the areas of, bank services, 9 of 31 (29 %), travel, 11 of 63 (17 %) and games, 10 of 63 (16 %) (Table 4). In contrast there was less interest in sharing knowledge, in the area of travel, only 7 of 63 (11%) were very interested and in each of the areas, professional skills and games 20 of 63 (32%) were a little interested in sharing their own knowledge. Sharing knowledge is, as shown by Tissen et al. [37], Wu [38] and Hislop [39], not to be taken for granted, as people often want something in return for their knowledge and without such can be reluctant to share.

As Harris and Ezeh [31] show in Figure 5, there are a lot of different components for winning the credibility and trust of the customer, and if these factors are not fulfilled the customer will look for an alternative solution to their needs and demands. The service provider and the servicescape will need credibility to attract the young-elderly, but so far only a few branches have been successful. The travel industry, as well as the bank industry, are, from a customer point of view, the leaders in getting their customers to use the services they offer and thereby they have been successful in gaining their trust.

7 Conclusions

According to the above discussion, including findings and theories, we can highlight three issues of importance.
- Servescapse – the interface on the digital devices
- Trust – who is responsible for the digital services
- Credibility – customer familiarity with service providers
For this group of young-elderly, trust and credibility are important with regards to the available digital services within the servicescape. By learning more and knowing the group better the service provider can move from creating for to creating with and creating by the user and can thereby strengthen credibility and trust in the service and servicescape.

The above presented conclusions indicate that the developers of digital services and service providers have to co-operate with marketing practitioners. But co-operation is not enough, they have to learn more about the young-elderly, especially about their needs, demands and values, in order to gain credibility and to earn the trust of this growing target market.

8 Proposal for further research

As shown in this paper, there is a disparity between what the young-elderly demand and need and the digital services provided, meaning that IS developers have to learn more about this target group. Therefore we suggest that more research needs to be done in order to gain more knowledge about the group of young-elderly. We also encourage research on whether or not differences in, for instance, gender, background, levels of education and economic situations would impact the young-elderly group’s interest in digital services. In addition to these proposals, we believe that more research on how to earn the trust of the young-elderly and how to build a servicescape that captures their interest is vital.

9 Acknowledgements

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Young-elderly and digital services

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Abstract. In this paper we show what kind of services the group known as young-elderly (60-75 years old) in Sweden use on the Internet. To be able to develop more effective information systems (IS) we want to know more about the actual demands, needs and wants of the young-elderly target group. We will, through an explorative study conducted by three focus group interviews, show the importance of knowing behavioral factors when designing effective IS and setting up interactive virtual servicescapes. Our conclusions are that when developing IS and setting up virtual servicescapes on the Internet, it is not only necessary to know the customers’ demands, needs and want, but also to create customer trust of the service provider and the services. In addition, it is also necessary to be able to develop support services that help the customers find what they want and allow them to customize the digital service interface. Together, this will minimize anxiety of the growing young-elderly target group.

Keywords: Information Systems (IS), Digital Services, Marketing, Trust, Digital Guiding, Digital Customization, Resistance, Servicescape, Young-elderly

1 Introduction

The group of elderly people is going through a major expansion in many countries all over the world. People are healthier, the age pyramid is changing rapidly as life expectancy increases and the group consisting of people over 60 years of age represents a larger portion of the total population. Some people can even expect to live past 100 years of age [1] [2].

We - the authors - work as lecturers in marketing and aim to discuss marketing from a marketer’s point of view in combination with information systems (IS). With our skills based on studies and our long track-records as practitioners in marketing and business, we aim to analyze the group of people who are retired or will soon retire from work, with a focus on their relationship to IS and their response to what the digital service industry offers on the Internet today and tomorrow.
In this paper, and in a first paper [3] with focus groups, we argue that digital services can play an important role in addressing the above mentioned problems and therefore there is a need to understand the way in which the young-elderly group uses and behaves on the Internet as well as their usage of digital services on computers and mobile devices.

Age groups are changing over time but some previous studies have defined young-elderly as people from 60 to 75 years old and older-elderly as people over 75 years old [4] [5]. The group of young-elderly is growing in many countries all over the world. This creates challenges and opportunities for the society, their families and for the individuals themselves. One opportunity would be to make this group more active after retirement, making use of their lifetime experiences and knowledge and acknowledge them as a resource for society. This can be a way to decrease the gap between public service demands and public resources available in Sweden’s existing system of finance [1] [6]. One way to activate this group is to match service resources with service demands in a more effective way with the help of technology and digital services in interactive virtual servicescapes [2] [7].

In this study we present the perceived barriers for the young-elderly to using services that exist on the Internet and their demands for such services today and in the future. In particular, we will cover the variables, trust and resistance, of the young-elderly, according to their opinions towards digital services. This paper will focus on the intersection between IS and Marketing, where the IS area will mainly focus on user need analysis as input to the system design process and Marketing will focus upon behavioral aspects of needs and wants with an emphasis on servicescape theory. It will be interesting to know more about whether or not marketing, with the help of servicescape theory, can provide better digital services in the eyes of the consumer. Both approaches have the same aim and should be coordinated. This study will give details and a deeper understanding about behavior, beliefs, demands and requirements in terms of digital services on the Internet now and in the future. We aim to highlight some valuable insights for Internet service providers in terms of their design and development processes. For example, how integration and interaction with the group of young-elderly can impact the creation, delivery and consumption of digital services.

1.1 Purpose of the Study

The purpose of this study is to explore (i) what kind of digital services the young-elderly are using on the Internet today, and also to describe (ii) how such digital services on the Internet could be designed to attract and involve the young-elderly group from a servicescape perspective. This study will be one in a series of steps to discover and learn more about specific requirements based on the demands and needs of the young-elderly user group, to identify and tackle barriers of usage, and to give input to digital services providers when developing new applications in close interaction with the service consumer.
1.2 Research Questions

Since the group of young-elderly in Sweden is growing both in size and importance we are curious about:

(i) How does the group of young-elderly utilize digital services?
(ii) What conditions are necessary in order to motivate young-elderly to use digital services?

1.3 Structure of this Paper

This paper will be structured as follows: Section 2: Background. Section 3: Literature Review. Section 4: Study and Method. Section 5: Findings. Section 6: Discussion. Section 7: Conclusions. Section 8: Future Research.

2 Background

People live longer and longer due to improved nutrition, sanitation, medical innovations, health care, education and economic wellbeing. The United Nations (UN), through its organization, the United Nations Population Fund (UNFPA), has studied ageing in the twenty-first century and states that in 1950 around 205 million people in the whole world were 60 years old or older. In 2012 that figure increased to 810 million people. The forecast indicates that the number will be 1 billion within 10 years and that figure will at least double by 2050 [2]. Between 2012 and 2050 it is predicted that the older population in Europe will grow from around 20% to 35% of the total population, in Asia from 10% to 25% and in Sweden from 18% to over 32% [1][6].

Technology and digital services can overcome the disadvantages, isolation and marginalization experienced by many older persons. Technology can also create a sense of security in the home, facilitate health care, introduce new attractions and wellbeing into older people’s lives and create greater access to information [2]. Technology can also make it possible for older people to continue to work later in life (e.g. telecommuting, which is working away from the workplace using technologies with Internet access). A study from New Zealand showed that the main motivations for older people to use the Internet were: communicating with others; building and maintaining relationships; shopping; and searching for information relating to goods, services, news and health. Of the Internet users, 87% also used e-mail on a frequent basis [8]. A huge percentage of older people often prefer to access information through traditional media, such as radio, television and newspapers [2][9]. This is also manifested by the fact of that many older people have a lack of confidence or interest in new technology and digital services. Studies have also shown that poor or irrelevant design, as well as constraints such as lower literacy levels among older people can be barriers to trying and using new technologies [2][10].

From our perspective, in the Internet era the group of young-elderly is at the intersection between people who are familiar with using digital services and those who have little or no experience in doing so. The habits that this group acquires will
stay with them as they continue to age and create the conditions for a higher quality of life.

While technology is already playing an increasing part in many older people’s lives, it is highly probable that coming generations of older persons will be able to make even more use of technology [9].

3 Literature Review

In this section we present the literature review. We will start by presenting IS in general and continue with resistance and trust relating to user adoption of IS and finally we will end with marketing with an emphasis on servicescape and virtual services.

3.1 Information Systems (IS)

One standard definition of an IS is that it should been able to collect, process and distribute data. People, hardware, software and networks that are connected and related to each other are base components of an IS [11]. Even if Langefors’ classical infological equation: \( I = i(D,S,t) \), where \( I \) = the information conveyed, \( i \) = the information process, \( D \) = the data, \( S \) = the preknowledge or frame reference of the information receiver, and \( t \) = the time required or available for the process, has been criticized for being too mechanic, it is still the starting point for focusing on the personal/social user perspective when designing and constructing IS [12]. This initiates the need for a user perspective and interaction in the design process and will influence the acceptance of new technology.

The social network around individuals is extremely important for its ability to influence the individual to try and test innovations and new technology [13]. This indicates that it is important both to study the individual as well as the network affecting the individual.

In a study of buying behavior on-line, Browne, Durrett and Wetherbe [14] point out that the Internet has not removed the need for face-to-face and voice-to-voice contact between people and that it has not reduced the importance of customer service before and after sales. The authors state that a problem with purchasing goods and services on-line is that technique lags technology. This means that business processes and individual behaviors change more slowly than the enabling and adopting technologies [14]. This problem is not new. With the Internet, technique is struggling to catch technology. The Internet requires process transformations that are both internal and external; internal processes of organizations that provide goods and service but also external processes of consumers called the consumption processes [15]. “A consumption process is a series of steps and tasks that people use to fulfill a need” [14, p.238]. The essence of that is that companies working within the information system industry need to understand and adopt the relevant consumption process to be able to provide effective services on the Internet [14].
3.2 Resistance

User resistance is one very important issue to be dealt with during the implementation of new information technology (IT) and IS applications. It has been widely covered in studies focusing on organizational implementation of IS. For example, several researchers have studied the impact of user acceptance of new technology in various TAM:s (Technology Acceptance Model) to be able to explain human personal behavior [16] [17].

Numerous studies demonstrate that user resistance originates from negative user assessments of the fairness of the exchange between their inputs and the outcomes of their interaction [18] [19].

Previous research has also shown that if the IS application could be flexible and meet the specific user at an individual level, it would be easier to develop the system and the interaction which will also influence future attributions [20]. Perceived threats in connection to the unwillingness to try new IS often corresponds to the negative assessments that users make of the system implementation [20]. Joshi [18] argues for an equity theory of resistance wherein individuals assess an IS implementation in terms of equity. Resistance arises from negative user perceptions of the fairness of the exchange between inputs and outcomes when using IS. Marakas and Hornik [19] mean that passive resistance is a result of threats that the individuals associate with the introduction of IS in their daily lives. They propose that individuals who are unwilling to adjust may enact “…overt cooperation and acceptance of the proposed system combined with covert resistance and likely sabotage of the implementation effort” [19, p.208]. Even if passive resistance is more covered when implementing IS in organizations, this knowledge could be transformed when creating digital services on the Internet.

In some studies, Davis [16] verified that perceived usefulness is highly connected to user acceptance and instrumental in decreasing user resistance and therefore should not be ignored by those involved in designing and developing successful IS.

3.3 Trust

Trust is a very complex aspect related to many different disciplines. Previously, many researchers have covered this aspect in, for example, social psychology [21], sociology [22], marketing [23] and in IS [24]. Many of them conclude that trust is essential in nearly all contexts of relational exchanges [24] [25].

In e-commerce, the physical-to-virtual transfer of commercial activity forces all of us to rethink the ways in which traditional rules for building trust and loyalty can be applied [20]. Rivard and Lapointe [20] maintain that it is important to establish the credibility of the message being sent as well as the source of that message. This means that trust is important in a servicescape since if there is a lack of trust the customers will reject the offered services. Papadopoulou et al. [24] discuss trust in e-commerce and they connect trust to relationship marketing and servicescape. Doney and Cannon’s [26] studies identified five trust-building processes; calculative, prediction, capability, intentionality, and transference, and Papadopoulou et al. [24] added credibility to that list. This was formed into a model for trust formation in
digital service applications and in e-commerce in virtual servicescapes. The three trust building processes in the model and adopted to the E-servicescape are:

- **Make a promise** means interactivity (e.g. interactive advertising with agents, messages rendering with real-time segmentation during interaction, messages exposures and customer responses occur in real-time and full interactive, personalized communication)
- **Enable a promise** includes neutrality (e.g. extensive search and recommendations driven by the customers, objective and neutral presentations, preview and experience of 3D virtual products, personalized dialogue and interaction with agents and orders being placed at same time and space with promise made)
- **Keep a promise** includes payments and delivery (e.g. online payments, online or physical delivery and after-sales service at time and space of purchase) [24].

To create a trustworthy electronic servicescape, Papadopoulou et al. [24] suggest that Web sites should be transformed to customer-centric, e-servicescapes offering a digital experience that can contribute to the development of an indelible relationship between the business and the customer. Trust can also be transformed through the customer’s own network by recommendations from others. This will lead to the customer being open for trying the digital service encounter. Trust as a process over time increases customer loyalty as the customer engages in repeated interactions with promises being fulfilled within the servicescape [24]. “Each time a promise is made, enabled and kept, it is evaluated with the intentionality, the capability and the credibility process confirming the customer’s trusting beliefs in the business benevolence, competence and credibility. The level of trust is also related to the experience that the customer gains within the e-servicescape” [24, p.327]. Virtual digital services, including web avatars and agents made familiar with customer behavior and preferences through collected data, provide the customers with alternatives during their searches in accordance with previous experience, and suggest suitable service alternatives to enrich the customer experience. There are many technological challenges but also many opportunities to build up strong servicescapes for digital services [24]. Alter [27] has focused on the importance of treating customers as co-producers and that value for the customer, is coproduced by the provider and the customer together, rather than just obtaining customer requirements and thereby building the digital service application.

### 3.4 Marketing, Servicescapes and Virtual Services

Marketing has gone through some different stages during the years. One starting point from the theoretical side was with Kotler’s [28] definition of *A Generic Concept of Marketing* where he sees marketing as the disciplined task of creating and offering values to others for the purpose of achieving a desired response [28]. As a result of that, he defined the marketer as a specialist in understanding human wants and values and knowing what it will take for someone to act [28]. This definition was refined by Kotler [29] when he added the atmospheric variable to the theory, meaning the effort to design buying environments to produce specific emotional effects on the buyer that
enhance his purchase probability [29]. Atmosphere is recognized through our senses. That led to the first theoretical approaches within sensory marketing. Achrol and Kotler [30] renewed their findings to include that in the digital third millennium “the growing impact of digitization and virtual media considerably expand the scope and impact of sensory satisfactions” [30, p.50].

In service marketing Bitner [31] was one of the first to define the term servicescape in reference to the physical surroundings as fashioned by service organizations to facilitate the provision of service offerings to customers by different kinds of service providers. Her studies introduced the importance of viewing service marketing through an environmental psychological lens [32]. Ezeh and Harris [33] argue that the design of the servicescape is the major attribute in being able to set up effective service marketing operations. They have also proved in some studies that four variables are very essential for the creation of servicescapes. These four variables are:

- **Ambient conditions** which include music, aroma and cleanliness issues
- **Design factors** which deal with implicit communicators and furnishing
- **Staff behavior** includes the personalized factors connected to customer orientation and credibility
- **Staff image** includes personnel competence and physical attractiveness [33].

Most existing studies have been made based on tangible features for example, buildings and decorations, but also intangible features for example, temperature, color, scent and music for physical stores.

In a study of health care services, Lee [34] showed that to create a servicescape that can satisfy customers’ needs for comfort, convenience, safety, security, privacy and support, healthcare providers need to understand which servicescape features impact customer satisfaction and behavior and how. Edvardsson et al. [35] extended previous servicescape models to also focus on the technology aspect of service interactions, meaning that technology can play an important part in both physical and digital service environments. He also introduced a new term relating to servicescapes, experience room, by which he means a place allowing representations of simulated service experiences.

Grönroos [36] and other researchers have pointed out the importance of customer participation and interaction in the creation of the service. This is an important ingredient in the process of creating value for the customer. To understand the nature of service creation it is important to understand two important parts of service. The first is, activities, and the second is, function, and they have to be shaped in a way that attracts and adds value to the user [37].

Goodwin [38] showed that service personalization is very strongly connected to the perception of functional quality. Customer uniqueness and personalization means that the customer if offered many flexible choices to develop their own customized service from a service provider. The customer gains the best possible form of service offer according to his or her needs and demands [39]. In creating services that are perceived as unique for every customer the service itself must be designed and delivered in a variety of ways, at least one of which will meet the needs and demands of the specific customer [38].

Studies have verified the importance of involving and observing your service
customers during the innovation process in order to develop new services. They emphasize that understanding the underlying reasons beyond behavior is important because it helps to better identify what can be done to improve the current use experience or to remove barriers of use [7] [40] and claim that virtual reality technologies can effectively be useful to shape an e-commerce environment. “Virtual services and virtual worlds are often described as three-dimensional, voice enabled, social environments that include a spatial layout, aesthetics and ambient conditions. In other words, all of the conditions needed to provide customers with social networking and servicescape opportunities” [32, p.736]. In a study, Edvardsson et al. [35] showed that the service providers in their work with the servicescape have to integrate the customer and move from creating for, to creating with and creating by the user. By integrating the customer it is thereby possible to strengthen trust and overcome resistance of the service and the servicescape.

4 Study and Method

In this section we describe our study and method. This study is the second in row of studies covering the use of digital services by the target group. The first study had a more quantitative approach [35]. Based on that study we realized that we needed to have direct access to the respondents in order to know more about them, to be able to ask more questions and to discuss issues relating to digital services. In this, the second study, three focus group interviews were performed with three different groups of people fitting into the young-elderly target group. The groups are anonymous out of consideration for the respondents, and are labeled; Group A, Group B and Group C. The studies were conducted in order, starting with Group A and ending with Group C, during a three month time period. The people in the focus groups were members of three different networks. The members of the groups had, as far as we know, no connection to members of the other groups. The first group was mostly retired people who bowl together weekly. We got in contact with the group through a member who was able to give us access. The second and third groups contained two different groups of retired people who were friends that played boule together. The reason for focusing on these groups was to find young-elderly who are still physically and mentally active. We are aware that this way of selecting respondents has its limitations as the number of respondents is small and not all young-elderly are active people. Therefore these three groups cannot be seen as representative for all young-elderly. On the other hand there is an advantage to having a personal connection to the groups as they are more willing to answer the questions and do so in an honest way. Some of them made it very clear that they never answer questionnaires otherwise.

We chose focus group interviews as a means for the study in order to get the information we needed to answer the research questions and to gain a greater understanding. The intention was to understand the target group’s opinions of digital services on the Internet and to compare the findings with other studies and statements from the literature. The questions were open, with a character of discussions, and extra questions were added, if necessary, since we wanted to build upon the answers to get an even deeper knowledge and understanding about the specific subject. Before we started the interviews, the respondents were advised that they could withdraw their
consent and cease participation at any time. The respondents were also advised of the purpose of the study and assured that their responses would be treated confidentially. The approach was mainly qualitative in this explorative study and we wanted to build on learning-by-doing which is close to the grounded theory methodology [41] and research techniques proposed by Checkland and Holwell [42] as especially suitable for research about information technology and information systems. This approach using open-ended dialogues instead of structured checklist can be an advantage in a learning-by-doing approach since it will not reduce and humiliate the interviewee [43].

While working with research it is of great importance that everything is done to reach a high level of reliability and validity. Reliability is about the trust and confidence in the research process and how it is designed and carried out. If you repeat research studies over time they should generate the same results. Validity concentrates on that the researcher is measuring what is intended to be measured [41] [44] [45]. We have spoken with young-elderly people in our families, among our friends and in our networks and have also followed recent media discussions. Our credibility was granted by our good relationship leading to high participation and small internal fall-off.

Each form of data is useful for both verification and generation of theory, whatever the primacy of emphasis [41]. We also recorded all of group discussions, and we had the possibility follow up after the discussion to clarify issues covered during the focus group discussions. These actions helped us validate our findings and also make it more reliable and more trustworthy even if the sample is quite small. When it comes to generalization we refer to Glaser and Strauss [41] and Gummesson [44] who state that too much attention is paid to generalization and that generalization is possible even from single events. But we are also very much aware of the small number of respondents and that our means of selection has its limitations and therefore it is important to take caution with generalization. Much more research has to be performed in order to make the results valid and reliable for the entire group of young-elderly. The results from our study are only representative for these specific groups of young-elderly.

This study, the second study in a row of our research storyline, will be followed by a larger quantitative and qualitative study which will probably lead to a TAM study and some evaluation studies in the end.

### 3.1 Brief Description of the Groups

Group A was a focus group of 8 people, Group B was a focus group of 6 people and Group C was a focus group of 8 people all retired but active. In total the groups consisted of 50% each men and women, who have different educational and occupational backgrounds. All the groups consisted of both people living in towns as well as in the countryside. The groups were also geographically separated from each other.
3.2 Question Areas

In Group A, the questions concentrated on: the background data of the respondents (e.g. gender, marital status, previous occupation, educational background); the need and actual usage of services according to the young-elderly, with an emphasis on digital services on the internet today (e.g. we presented services such as health related services, financial services, travelling services, and more). We also asked questions relating to estimated future usage of different kinds of services (e.g. which kind of services they are lacking and what services they could think of using in the future). There were also questions regarding services they could take active part in and/or share information and knowledge about (e.g. if they share information on social medias such as Facebook, Twitter or other social networks).

The question areas in Group B were based on the results from the previous group and more focused on why the respondents do not use different services on the Internet and why they do not share information and knowledge with other people (e.g. what is holding them back in using digital services and what are the obstacles to overcome in order to, if possible, get them to share information on Internet, not just search for information).

Group C’s question areas focused on the previous studies and concentrated on how to overcome user resistance, creating trust and to attenuate anxiety of using digital services on the Internet (e.g. why they don’t try things before they say no to using services and what they believe could make them try new services).

In Figure 1, we illustrate the main question areas according to the different focus groups and the step-by-step process of finding out more about the behavior in our young-elderly groups.

![Fig. 1. Question areas for the selected focus groups](image)

4.2 Data Analysis

All of the focus group interviews were recorded and we saved the material on our computers. Right after the interviews we listened through the recordings a couple of times and wrote down the discussions, answers and comments. Thereafter we counted
all the answers together and highlighted the issues that were intensively discussed and things that were brought up by many respondents.

5 Findings

The results from the interview with focus Group A, showed that the group uses some Internet services frequently and that they all had access to the Internet. They mainly used the Internet for; i) searching for information and very few shared information, knowledge and/or opinions. They comment that in some cases they ii) were forced into using services on the Internet (e.g. bank services, healthcare services and communication with organizations and the authorities). All of the respondents mentioned bank services in that many banks are closing their physical offices, decreasing opening hours and personal services, increasing the costs for services in bank offices and more, all of which are forcing customers to use Internet services whether they want to or not. There were; iii) no variances in opinions based on variables such as gender, age (within the young-elderly group), educational background and previous profession. Some comments from the respondents were:

“- To share things and to always search for things on the Internet is not normal for our generation. It is for the younger generation.”
“- There are so many things out there and it is so difficult to find things that you are really looking for. We often listen, respond and react to recommendations from our family and friends.”

The results thrilled us to move on to focus Group B where the focus emphasized why they do not utilize services available through the Internet today. The results from the focus Group B interview showed that the target group was extremely concerned about having a; i) personal connection with the people taking an active part in services on the Internet (e.g. when discussing health issues they want to see and have direct communication with the expert/doctor and also, if necessary, a history with that person). They felt that they; ii) need to feel confident in who are they interacting with, what kind of knowledge that person has, what kind of previous track record that person has and what will happen with the information they are willing to share and discuss? They also felt; iii) worried about entering new services, as a whole, even if it was just for trial reasons. As one respondent said:

“- I need the personal interaction where it can be a give and take. We belong to a generation that is accustomed to meeting face-to-face and where a handshake is real one, not just a digital one.”

Based on previous findings we wanted to know more about how to overcome the perceived problems, lack of trust and resistance to using digital services. This could be connected to earlier studies in which digital service providers in their work with the servicescape have to integrate the customer and move from creating for, to creating with and creating by the user. By integrating the customer it is thereby possible to strengthen the trust and overcome resistance of the service and the
servicescape. This can be achieved, for example, by treating the customers as coproducers so that value (perceived higher) for the customer, is coproduced by the provider and the customer together [35] [27]. This is what we want to know more about. With the third and final focus Group C, we concentrated the questions around why they felt anxiety in trying digital services and in sharing information, knowledge and opinions on digital service applications and social media. We found that it was three things that concerned the young-elderly relating to previous results. First, they indicate that they need to i) feel secure. Secure that their data, identity, username, password, credit card number, comments and knowledge are not abused and/or hijacked in any way. Secure that they are communicating with the right person. Secure about that person’s good intentions. Second, they need ii) personal touch and guidance about digital services. Personal touch means recommendations from others they know, actual people to contact before using the service or to help them find the right kind of service for them. One of the people in the group said:

“- I want to have, if not a real person, online, at least a guide helping me to find what I am looking for and what I really need. Like the service you could find online when you book your car service on the Volvo site, Volvo 2.0, and you get additional advice to update your car, the car service, the car history and financial issues according to your specific need and usage with the help of a digital person.”

Third, they think iii) some service applications are so general and offer too many options which only complicates things. Therefore they want to have the ability to decrease the number of options to just those alternatives that they really want. They want to iv) customize the service options through interaction with the service provider. One person in the group commented about Facebook:

“- There are so many options available that I have problems really reading the small text blocks and things not relevant for me are popping up the whole time. I would like to have much fewer options but larger and clearer text and buttons.”

Fig. 2. Results from the focus groups
All the respondents felt more or less the same in terms of the reasons why they do not use some digital services and why they find it irrelevant for them to share knowledge, information and opinions on the Internet with others. But, even if the answers point in the same direction we are not claiming that the results speak for all young-elderly people. We want to state that the results only speak for these specific groups.

6 Discussion

The young-elderly group consists of Internet users who have a lot of knowledge and experiences. It takes a lot to get them interested in digital services as they are a group that prefers personal contacts and face-to-face meetings. On the Internet there are many IS designed and launched to attract and add value to the users. During our study we have seen possible patterns which indicate that when designing IS the young-elderly, the service providers lack information about that target group. The young-elderly group is interesting for the IS industry as it is a rapidly growing group and they are becoming more and more active since the age pyramid is shifting upwards.

Our study shows that all respondents in our three focus groups have their own computer, smartphone or tablet and they have access to the Internet and use it nearly every day. This shows that the respondents in our groups are a very active group and are have a higher rate of Internet use than the average person, according to national investigations of the Swedish inhabitants’ relationship to IT and Internet [2] [9]. The young-elderly mostly use the Internet to search for information and for basic communication services such as e-mail, some social medias, reading news, making reservations and utilizing banking and financial services. In our research we have identified issues as to why the young-elderly group does not take advantage of the present services available on Internet today. Very few of the respondents use interactive services frequently. Some of them were not even interested in trying new services to see if they might be of interest to them.

The young-elderly group belongs to a generation for which technology and the Internet are not a natural part of everyday life. They are comfortable with traditional service supply and are used to dealing with their demands and needs through traditional service providers and have less interest in digital services on the Internet [9] [35]. The idea that the group feels that digital services and opportunities are not always relevant for them indicates that IS have perhaps been too focused on technology issues rather than on real user demand. This has been recognized in previous research covering design issues in developing IS [42] [11] [12] [13] [14] [15] [20].

The differences in what existing digital services actually present and the perceived demand and needs from the target group is also manifested by the fact that the target group has difficulty in seeing how using digital services, instead of more traditional service providers, is of any great benefit to them. They also name security issues as one large obstacle and want to see easier systems and proof of the service provider track record in order to overcome their anxiety. These reactions are also in line with user resistance and a lack of trust for the digital service provider. Issues of resistance and trust have been covered by many previous studies [16] [17] [18] [19] [20] [21]
and they are often a result little or no involvement or interaction between supplier and user. This has been recognized by some researchers as proof of bad servicescapes [28] [29] [30] [37] [38].

Therefore we suggest that the service providers work together with potential users of digital service applications from the young-elderly group in the development of new service applications in accordance with what the users want and need. When developing digital servicescapes the IS designers should consider the requirements and wants of the target group. Besides demands and needs, service providers need to add value and to build up trust and customer loyalty over time. In addition, they need to be trustworthy so that the potential users start using the services and overcome their resistance to interact in a digital servicescape and to share knowledge, information and opinions [16] [17] [24] [14] [31] [32] [33] [34] [35] [36] [37]. From a marketing perspective the customer meets a servicescape when they are using digital services on the Internet regardless if they do so on a computer or through any kind of mobile device.

When designers of servicescapes develop new IS they want them to be as attractive as possible. To be able to deliver attractive services they also need to deliver value for the user and the customer. That value can come from helping the customer to overcome user resistance with for example, the help of virtual services, such as avatars and agents, meaning that the customer starts using the service [7] [24] [25] [38] [40]. Another important issue is to customize the interface between user and service provider, letting the customer have their own personalized service layout to fulfill their needs, wants and demands but also creating a feeling of a more personalized interaction and being able to overcome resistance [32] [35] [38]. The service providers and the servicescapes need trust with low resistance, guidance and customization to attract the young-elderly group but according to our findings very few have been successful enough.

7 Conclusion

In this paper we have shown that service encounters and Internet software companies have to consider the special requirements of the expanding young-elderly target group. They have special needs, wants and demands, all of which must be considered in order to diminish the perceived anxiety and to build up trust of service providers. In focus has been overcoming the resistance of trying digital services, sharing information and knowledge with others and building up effective virtual servicescapes in which the users are involved in the design and development of the service and interact when consuming or using the service.

According to the results presented in the discussion section, including findings and theories, we can put a special focus upon three issues of importance:

- Servicescape, the virtual interface on technical devices as computers and mobile devices
- Trust and resistance, who is responsible for and stands behind the IS
- Guidance and customization, handling the interface between users or providers of IS and users.
For this young-elderly group, trust, guidance and customization with regards to IS in the servicescape, are very important. Society needs to prepare for the economic pressure that the welfare system will face when the older age group increases in size and the financial system is stressed. Service based IS are therefore of great importance for society, as well for individuals, giving them opportunities for cost-effective solutions and the possibility to share knowledge, information and opinions. It is therefore of the utmost importance that IS are designed in a way that attracts and meet the demands and needs of the young-elderly target group. How this will differ from prevailing IS design standards will be one of the aims of our coming studies.

The final conclusion of this paper is that when designing new IS the service provider has to consider marketing issues according to customer demands, needs and values. They also need to know more about their target group to be able to customize the services and guide them to start testing and using the services in order to overcome user resistance and to gain the trust of the growing group of young-elderly.

8 Future research

In this paper we have shown that it is the underlying issues related to trust and user resistance which prevent many in the young-elderly group from participating in digital social networks and communities, from using available information and from sharing experiences and knowledge on the Internet. This indicates that there is disparity between what the target group of young-elderly demand and need, and the actual digital services provided. This needs to be further studied and verified in future research.

We would like to propose more focused research of the young-elderly group with a focus on how to build up trust and to overcome resistance to digital services and servicescapes on the Internet.

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Abstract. Data governance is an emerging research area getting attention from information systems (IS) scholars and practitioners. In this paper I take a look at existing literature and current state-of-the-art in data governance. I found out that there is only a limited amount of existing scientific literature, but many practitioners are already treating data as a valuable corporate asset. The paper describes an action design research project that will be conducted in 2012-2016 and is expected to result in a generic data governance framework.

Keywords: Data Governance, Data Quality, Data Management, Data Strategy, Enterprise Systems, ES, Business-IT Alignment, Action Design Research

1 Introduction

Companies should treat corporate data as a key strategic asset in order to achieve a sustainable competitive advantage. During the past decades most of the successful companies have already invested in optimizing production facilities and equipment, fine-tuning financial monitoring and reporting mechanisms, improving employee productivity, and implementing the latest information systems (IS). Therefore, it is more and more difficult to get a satisfactory return on investment with these traditional corporate assets.

Like any other asset, data needs good corporate governance. A huge amount of data is already generated in, for example, customer relationship management (CRM), supply chain management (SCM), and many other enterprise systems (ES). However, it is not enough to just capture and store data, because unmanaged data leads to poor data quality and increases the cost of business transactions. Data governance would be accompanied by immediate revenue increases and cost cuts, which create increased shareholder value.

Data governance is a relatively new research area without an established definition. It combines best practices from many fields such as strategic management, business process management and risk management. Although the roots of data governance research are in the early 1980s still today most of the existing research is focusing on some specific area. Therefore, there is a need for a holistic approach giving guidance how companies should establish and improve their data governance.

The research objective is to design a generic data governance framework for
globally operating companies. The case studies in this research will give us an understanding of data governance in complex enterprise environments. Moreover, this research extends experience and adds strength to what is already known through previous research. The research analyzes real-life situations and provides a basis for the application of ideas and extension of models, methods, and practice in business environments and in future research.

In this paper I first review the existing literature on data governance and data quality. Second, I discuss the research approach including the Action Design Research method, the implementation plan for the research in 2012-2016, and the research objectives. Third, I discuss current state-of-the-art in data governance including its implications on data quality and big data as well as how to organize data governance. Finally, the paper ends with a conclusion.

2 Background

Data governance ultimately aims at creating a competitive advantage for companies by creating a holistic approach to important organizational data and the research area has its roots in the early 1980s data quality research. I will discuss this in greater detail after addressing some key concepts.

In information systems related discussion it is common to refer to the following Ackoff’s [1] definitions: data is representation of facts, information is data in context, and knowledge is information in perspective, integrated into a viewpoint based on information and experience. However, in this paper I use the common practice in data quality research and use the terms data and information alternatively.

It is also important to discuss the relation of data governance to corporate governance and IT governance. According to Weil and Ross [2] corporate governance means that the Board and senior executive team are responsible for the strategy, which aims at desirable behavior exploiting the key assets of the company. An important key asset on their list is Information and IT assets, which stresses the importance of information and not only technology. On the other hand, Wende [3] argues that “data governance and IT governance are coequal and both have to follow corporate governance principles”. She also emphasizes that data governance is not a subset of IT governance and needs even more “close collaboration among IT and business professionals who understand the data and its business purpose”.

2.1 Data Governance and competitive advantage

Davenport [4] argues that companies need enterprise-wide data strategy and governance to achieve competitive advantage. Moreover, he elaborates that companies have invested millions of dollars in enterprise systems that capture data from every conceivable source. For example, enterprise resource planning, customer relationship management, supply chain management, and other enterprise systems ensure that no transaction or other significant exchange occurs without leaving a mark. But to compete on that information, companies must present the information in
standard formats, integrate it, store it in a data warehouse, and make it easily accessible to anyone and everyone inside the organization and sometimes outside as well.

In their data quality related research Wang et al [5] noticed that establishing and maintaining trust in data quality is very important for data governance success. In their research they had a case organization they called “Financial Company”, which needed to provide real-time information about changes in customers’ account balances to internal data users. However, the internal users did not trust the data, which resulted in each department maintaining their own local databases. Therefore, the company did not have integrated customer account information, which in turn caused even more suspicions about the data.

Adelman et al [6] argue that every company needs a plan for improving the way it leverages its data. With the help of this plan, the company would be able to turn data into information, and eventually into knowledge that will then produce measurable improvements in business performance. Adelman et al illustrated the issue by arguing that working without data governance is analogous to a company allowing each department and each person within each department to develop its own financial chart of accounts. This empowerment allows each person in the organization to choose their own numbering scheme. Existing chart of accounts would be ignored as each person exercises their own creativity. Even those of us who are not into numbers understand the resulting chaos. Without data governance the chaos is not as obvious, but the indicators are easy to see: dirty data, redundant data, inconsistent data, inability to integrate, poor performance, terrible availability, little accountability, users who are increasingly dissatisfied with IT performance, and a general feeling that things are out of control. In addition, this gives a blank check to those who want to pursue their own agendas and it results in endless discussions and arguments whose numbers are correct.

Carr [7] argues in his classic Harvard Business Review article “IT doesn’t matter” that information technology is becoming a commodity and is not anymore a source of competitive advantage. However, he admits that his definition of IT does not include the information flowing in the systems and the people using them. Therefore, combining good quality information with human talent can often lead to business advantage.

2.2 Data Quality Research

Madnick et al [8] state that data quality research identifies data quality issues in organizations, investigates practices that improve or deteriorate data quality, and develops techniques and solutions for data quality management in an organizational setting. They continue that data and information quality issues have grown rapidly in light of the critical role played by the quality of information in our data-intensive, knowledge-based economy. In other words, data quality research has built a solid ground for data governance research as I will discuss in this section.

In the late 1980s early data quality research focused mainly on developing techniques for querying multiple data sources and building large data warehouses according to Madnick et al [8]. This work mainly focused on “entity resolution
issues” exploring ways to determine if separate records actually corresponded to the same entity (aka de-duplication or matching).

In the early 1990s researchers in MIT (Madnick & Wang [9]) founded the Total Data Quality Management (TDQM) framework. The TDQM defines continuous data quality improvement with the consecutive cycles of Define, Measure, Analyze, and Improve. This extends the better-known Total Quality Management (TQM) in the manufacturing domain to the data domain. In other words, Madnick and Wang argued that even though most organizations “manufacture” data, they do not treat it similarly. Later on Wang et al [5] drew on TDQM taking a product view of information and developed a modeling technique, called IPMap, to represent the manufacturing process of an information product (i.e. IP).

Lee et al. [10] drew on Wang’s et al information product framework. They developed a context-embedded IPMap to explicitly represent various contexts of information collection, storage, and use.

Redman’s (e.g. [11], [12], [13], [14]) seminal work has focused mainly on the importance of data assets, characteristics of data, and different data quality dimensions. Therefore, he has had a great influence especially on the data quality and data governance practitioner communities.

In the 2000s recent studies have shown evidence that the relationship between information quality and organizational outcomes is systematically measurable, and that the measurements of information quality can be used to predict organizational outcomes. (Sheng and Mykytyn [15], Slone [16], Brynjolfsson [17]). These papers were published as conference proceedings, but they are expected to gain more attention later on as completed journal papers. They should therefore have a definite impact on academia and practitioners.

### 2.3 Data Governance Research

Wang et al [5] argued already in the early 1990s that the information production process has to be treated as though it were producing a physical product for a customer. According to them, the process must be well defined and must contain adequate controls, including quality assurance, inspection, and production and delivery time management. Wang et al have contributed more to this research, but it mainly concentrates on the data quality aspect. This will be discussed in greater detail in data quality research section.

Despite Wang’s et al early findings, still in 2009 Fisher [18] argued that internally many organizations mistakenly view data as a “technological problem”. They continue that past efforts to solve these problems have too often resulted in expensive multi-year projects that have not paid promised dividends, and thus the projects have frequently failed. Executives know they want to trust data, but they do not know how to reach that point. When they have been burned by approving expensive IT projects that never delivered the intended results and promised ROI, the executives may be reluctant to invest in additional programs. Therefore, data is not a “technological problem”. It is every employee’s problem. It is every executive’s problem. And seeking a way to constructively and economically address data issues is paramount to success of the organization.
Otto [19] conducted a scientific literature review in 2011 and found that there are only 33 scientific papers regarding data governance in journals or conference proceedings, and the first one was published in 2005. In addition, there are seven scientific books, one working report, and two doctoral theses. Moreover, there are eight publications by industry associations and 18 relevant practice-oriented publications by software vendors and analysts. As we can see from these studies, the data governance research area is still very immature even though it is seen as a promising approach for companies to improve and maintain the quality of their data.

The first attempts to create a framework for data governance were published in 2007. The frameworks consist of Wende’s [3] scientific paper in the ACIS conference; IBM’s [20] (fairly light) data governance maturity model, and Radcliffe’s [21] “Gartner’s Seven Building Blocks”, which was the main authority for many master data management (MDM) practitioners for many years.

A few years later Khatri and Brown [22] and Weber et al. [23] rendered early definitions of data governance. Both agree that data governance refers to the entirety of decision rights and responsibilities regarding the management of data assets. In addition, in 2010 the industry association DAMA International published Data Management DM-BOK [24], which also contains some data governance concepts. The second edition of DM-BOK (which will emphasize the importance of data governance in all other data knowledge areas) is currently in review and will be published in the end of 2013.

However, as Otto [19] pointed out, all the previous approaches have in common that they focus on single aspects of data governance. This leads to isolated solutions. The fact that companies need to take into account a number of aspects when trying to organize data governance has so far been neglected. This gap both in the scientific and in the practical state of the art was the motivation for Otto’s contribution “Morphology of the Organization of Data Governance”. This provided a good foundation for empirical data governance research described in the next section of this paper.

3 Research Approach

3.1 Action Design Research

Action design research (ADR) (Sein et al. [25]; Purao et al. [26]) is a research method for generating prescriptive design knowledge through building and evaluating an ensemble of IT artifacts in an organizational setting. The ADR process (incl. the work packages (WP) of this study) is depicted in Figure 1 below.

ADR is based on four stages, with several iterative loops for doing highly interactive constructive research. The first stage, problem formulation, identifies and conceptualizes a research opportunity based on existing theories and technologies (Hevner et al. [27]).
The second stage of ADR, building, intervention, evaluation (BIE), uses the problem framing and theoretical premises adopted in stage one. These premises provide a platform for generating the initial design of the artifact, which is further shaped by organizational use and subsequent design cycles. Carried out as an iterative process in a target environment, this phase interweaves the building of the artifact, intervention in the organization, and evaluation. The outcome of the BIE stage is the realized design of the artifact. During BIE, the problem and the artifact are continually evaluated, and the design principles are articulated for the chosen class of systems.

The third, reflection and learning stage of ADR, moves conceptually from building a solution for a particular instance to applying that learning to a broader class of problems. This continuous stage parallels the first two stages. The stage acknowledges that the research process involves more than solving a problem. Conscious reflection on the problem framing, the theories chosen, and the emerging ensemble is critical to ensure that contributions to knowledge are identified. It is also important to adjust the research process based on early evaluation results to reflect the increasing understanding of the ensemble artifact. In practice this means that we pay close attention to the emerging issues during the project and articulate the learning from the cases so that other practitioners and researchers can later learn from the experiences. This stage acts as the key risks and contingency management tool in the project.

The fourth stage of ADR aims at formalizing the learning from the study. Following Van Aken [28], the situated learning from an ADR project should be further developed into general solution concepts or design rules. Casting the problem-instance into a class of problems (see stage one) facilitates this conceptual move. Researchers outline the accomplishments realized in the artifact and describe the organizational outcomes to formalize the learning.
3.2 Research Implementation

This Data Governance research is conducted as a part of a bigger research project focusing on ERP development networks in three enterprise-scale case organizations during 2012-2016. The study is divided into three subsequent sections; 1) understanding the context, 2) constructing and evaluating the model, and 3) formulating theoretical and practical in-depth understanding about the context.

In the first part, we will conduct a systematic literature analysis and a set of case studies of three globally operating organizations where several in-depth interviews of business and IT managers, end-users, developers, and consultants are conducted and their activities observed. My objective is to gain understanding about actors, their communication and interaction practices, and the use of different data governance methods and their alignment. I believe that this selection of case organizations will explain much of the variation in data governance between different companies.

The second part of the research will employ a constructive research approach to develop models, methods and practices for improving data governance and communication in the selected case organizations. My objective is first to build
models, methods and practices, employ them in a practical setting, and evaluate them there. Second, I will modify or enhance those models, methods, and practices according to the field experiences, and third, construct their aggregate to support the activities of the case organizations comprehensively.

The third part of the project consists of the fourth stage of ADR. Its objective is to formalize the learning. The results of the research will be published on annual basis in scientific journals and conferences.

3.3 Research Objective

The research objective is to design a generic data governance framework for globally operating companies. In addition, the case studies in this research will give us an understanding of data governance in complex enterprise environments and can extend experience or add strength to what is already known through previous research. The research analyzes real-life situations and provides a basis for the application of ideas and extension of models, methods, and practice in business environments and in future research.

The research will constitute a theory for my doctoral research on this area, where exists only limited scientific research by this far. Therefore, the research is expected to result in new knowledge for information systems science. In addition, it will contribute to practitioners such as business executives and IT managers by providing them with generalized, prescriptive, and practically relevant scientific knowledge for setting up and improving data governance capabilities in their organizations.

4 Current state-of-the-art in Data Governance

4.1 Data Governance in Practice

There is not a commonly accepted definition for data governance, but drawing on Otto [19] I repeat the definition presented also in Wikipedia “data governance is a set of processes that ensures that important data assets are formally managed throughout the enterprise”. As any other process improvement, data governance initiative needs to define suppliers, inputs, processes, outputs, and consumers. Moreover, it is not a one-time effort, but an evolutionary activity aiming at sustainable data quality management embedded in all core business processes.

Redman [14] argues that companies should get responsibility for data out of the IT department. First, it seems obvious enough that one should put management of data as close to the action as possible. The two most important moments in a piece of data's lifetime are the moment it is created and the moment it is used. These really interesting and important moments for data occur in the business, not in IT. Second, management responsibility should lie with the parties that have the most to gain or lose. Business departments gain mightily when they create new value from data. In
contrast, IT reaps little reward when data is used to improve a product, service, or decision. Nor does IT feel the pain when the data is wrong. It is the business that bears the consequence of poor decisions, increased costs, and angry customers.

Pierce et al [29] conducted a survey for over 200 large organizations in the USA to find out the state of data governance in practice. Over half of respondents (58%) reported that their organizations recognize information as a strategic asset and manage it accordingly. However, 17% were neutral on this question and 25% felt their organizations do not recognize information as a strategic asset. Although respondents were generally positive about the results and effectiveness of their organization’s information governance efforts to date, 86% of all survey participants expected those efforts to increase over the next 2 years. 56% of respondents indicated their organization’s information governance initiatives were still in the pre-implementation stages while 28% of respondents indicated that their organization’s first “iteration” had been implemented within the last few years.

There are no any as comprehensive studies about European organizations, but for example, Serén and Dahlberg [30] conducted a survey to 157 business and IT managers employed by the 500 biggest companies in Finland. They have conducted a similar “IT Barometer” survey for five years in a row, but this was the first time they added information management as its own series of research questions. They found out that 48% of companies agree strongly or partly that they manage information holistically and have a development roadmap for further improvements. In addition, there are, for example, major companies such as Nokia, Kone, Konecranes, Fiskars, Outokumpu, Outotec who are members in professional association DAMA Finland and share their experiences in the field.

4.2 Data Quality in Practice

Wang et al [5] define data quality as follows: “Information delivered is a total product: it includes all the attributes that in combination meet the information consumer’s expectation”. The goal is to ensure that the information product quality is fit for use. They continue that managers should embed the quality monitoring in all processes that produce information for its consumers, including systems design and development as well as the daily production and delivery of information.

Redman [13] lists seven common data quality issues. First, people cannot find data meaning that an employee may use 30% of workday searching for information and unsuccessfully every second time. Second, approximately 10-25% of records contain inaccuracies. Third, due to poor data definitions, data is frequently misinterpreted and cannot be shared between departments. Fourth, there are often privacy and security violations meaning, for example, that data is subject to loss and there is a risk of identity theft. Fifth, there is inconsistency across data sources, which is almost a norm with multiple processes. Sixth, there is too much data and, in fact, half of it is never used due to uncontrolled redundancy. Finally, there is organizational confusion and managers do not know, for example, what data is important or how much data is there.

Wang & Strong’s [31] framework captures dimensions of data quality (DQ) that are important to data consumers. Intrinsic DQ denotes that data have quality in their
own right. Contextual DQ highlights the requirement that data quality must be considered within the context of the task at hand. Representational DQ and accessibility DQ emphasize the importance of the role of systems. These findings are consistent with the understanding that high-quality data should be intrinsically good, contextually appropriate for the task, clearly represented, and accessible to the data consumer.

Batini et al [32] argue that the problem with previously existing data quality dimensions is the contextual nature of data quality, which causes numerous different dimension specifications for different purposes. They analyzed most important classifications in data quality literature and defined the basic set of data quality dimensions:

**Accuracy**: data reflects correctly the real world object (e.g. customer address is real or bank account balance correct)

**Completeness**: the expected data attributes are provided (e.g. ID, name, price, and description on product record)

**Consistency**: data is in synch across the enterprise; there is no duplication within or across systems (e.g. customer data in CRM and ERP are same)

**Timeliness**: data delivery time meets expectations (e.g. real-time or weekly batch load can both be alright depending on the need of the user)

Peter Aiken’s research team from Virginia Commonwealth University conducted a survey of data management practices in 175 organizations in 2002-2005. They categorized the findings together with Redman [13] who published the following Data Quality Maturity Model:

First, they found out that as many as 40% of organizations are Unconscious meaning that they are not aware of the data quality problems they incur. And ironically, they end up using most resources for correcting the data, because it is done in silos during normal work tasks. Second, 50% are reactive Cleaners who from time to time implement special data cleansing projects, usually inside other development projects. Third, 8% are Enlightened meaning that they have highly motivated individuals or teams who try to advance enterprise-wide data quality efforts. Fourth, 1% are Competitors who are fully on a new path meaning that there is much more than few committed leaders. There may be a central group leading the effort, but most departments are engaged. And finally, 1% are World-beaters who enjoy the competitive advantage of world-class data.

### 4.3 Data Governance and Big Data

According to Soares [33] organizations need to govern big data as they would other types of information such as master data and reference data. Governance is a crucial enabler to derive maximum value from a big data program. However, big data brings new challenges to governance because much of the data that organizations will want to leverage comes from outside their control, is less structured, and is much less understood than the transactional data they have traditionally dealt with. These new data types must be integrated with existing information governance and technology infrastructures.
McAfee and Brynjolfsson [34] argue that big data aims at translating analytical intelligence to competitive advantage. Moreover, they point out the main characteristics of big data, which also differentiate it from more traditional analytics. First, there is Volume meaning that in 2012 about 2,5 exabytes of data is created every day and the amount is doubling every three years. Second, there is Velocity meaning that organizations are nowadays able to capture, analyze, and react to data in real-time. Third, there is Variety meaning that data is available in many more formats than in structured relational databases as in the past.

Soares [34] presents a categorization for different types of big data. First, there is data generated in web & social media (can be used e.g. for sentiment analysis). Second, there is machine-to-machine data (can be used e.g. for patient monitoring in healthcare). Third, there is big transaction data (can be used for e.g. claims analytics). Fourth, there is biometric data (can be used e.g. for genetic testing). And fifth, there is human generated data (stored e.g. in electronic medical records).

Manuika et al [35] argue that many pioneering companies are already using big data to create value, and others need to explore how they can do the same if they are to compete. Companies churn out a huge volume of transactional data, capturing trillions of bytes of information about their customers, suppliers, and operations. There are millions of networked sensors that are being embedded in the physical world in devices such as mobile phones, smart energy meters, automobiles, and industrial machines that sense, create, and communicate data. Manuika’s et al research found out that data could create significant value for the world economy, enhancing the productivity and competitiveness of companies and the public sector and creating substantial economic surplus for consumers. For example, they estimated that the potential annual value to the health care of the USA amounts to $300 billion.

In conclusion, Davenport [4] discusses the need for data strategy or data governance. According to him, these programs do not operate just under a common label, but also under common leadership and with common technology and tools. In traditional companies, departments generally manage “business intelligence” in their own silos; number-crunching functions select their own tools, control their own data warehouses, and train their own people. But that way, chaos lies. Moreover, the increase of user-developed excel spreadsheets and databases inevitably leads to multiple versions of key indicators within an organization. Therefore, companies should nominate centralized groups to ensure that critical data and other resources are well managed and that different parts of the organization can share data easily, without the impediments of inconsistent formats, definitions, and standards.

4.4 Organizing Data Governance

Wang et al [5] are usually credited for creating the first Data Governance framework. They, however, called it Information Product (IP) approach, which consisted of four principles: 1) Understand information needs, 2) Manage information as the product of a well-defined process, 3) Manage information life-cycle, 4) Appoint information product manager (IPM) to manage the process and resulting product.
According to Wang et al [5] the IPM’s duties are, in essence, process management and coordination. Traditionally, the IT function has performed information process management (if it was performed at all), but they seldom focused on the information consumers and their needs. The poor quality of organizational information is commonly caused by the lack of coordination and shared knowledge among information consumers, manufacturers, and suppliers.

However, in the beginning of 2000s there was virtually no any guidance how to organize data governance. Later on IBM’s [20] information governance council maturity model described on high level goals, enablers, core disciplines, and supporting disciplines. Radcliffe [21] listed that it should include vision, strategy, governance, organization, processes, technology, and metrics. DAMA [24] presented its own “pie chart” of data management: data governance in the middle surrounded by e.g. data architecture, metadata management, master data management, and data warehousing.

In 2011 Otto [19] created a more comprehensive framework and argued that data governance consists of Goals and Structure. The goals can be divided in Formal business or IT goals and Functional goals. Structure, on the other hand, can be divided in Locus of control, Organizational form, and Roles & Committees.

In the same year, Orr [36] presented his version of Foundational requirements for data governance. Data governance must be Legitimate (i.e. formally sanctioned & endorsed), it has to Span control over data over all lines of business, it has to Span control over data process (incl. roles & responsibilities), it must have adequate (but actually quite modest) Funding, it must have Administrative visibility (i.e. close to CEO), the Senior management must be involved in high-level decisions and political navigation, and finally the members must have Skills and Organizational position for commanding respect and attention.

The goal of my research is to draw on Otto’s [19] more theoretical ideas and Orr’s [36] practice oriented requirements and to further develop the resulting framework in the case organizations. Finally, the intention is to generalize the framework so that it can be used in other similar globally operating companies.

5 Conclusion

This working paper describes a research outline aiming at designing a data governance framework for globally operating companies. In addition, it introduces my doctoral dissertation research on data governance and positions it in the context of existing research. First, I argue that corporate data should be viewed as a key strategic asset. As businesses and organizations become more reliant on technology, data and information quality becomes an increasing concern. Second, I review the existing literature on data governance and notice that there are only little scientific findings in this area so far. Third, I discuss the chosen Action Design Research method as well as the implementation plan for 2012-2016. The objective of the research is to result in new knowledge for information systems science regarding data governance. In addition, it will contribute to practitioners such as business executives and IT managers by providing them with generalized, prescriptive, and practically relevant
scientific knowledge for setting up and improving data governance capabilities in their organizations. Finally, I discuss the current state-of-the-art in data governance and the existing guidance how to establish data governance.

The main limitations of this paper are that it only introduces the research topic and does not yet include any empirical evidence or theory development. Following Gregor’s [37] classification of theories in IS, I expect that this research will use and develop theories for explaining and predicting as well as theories for design and action. Therefore, the next research step is to start collecting and analyzing the empirical data to provide a basis for theorizing.

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References

On organization of professions related to IS use

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Abstract. Organizations have been more knowledge-intensive and professional during the last decades. Professional work has generally certain specific properties related to its working context. Two different case studies have been conducted within two different work disciplines; aircraft maintenance and emergency health care. The two different types of professions are called T(hing)- and L(ife)-professions. This paper analyses the importance of management and organization of T and L-professions respectively, for their use of information systems. The aim of this paper is to highlight the specific characteristics for two different types of professions, T and L, and how they are affected by the organization and management. The aim is also to derive general challenges according to professionals’ use of information systems, related to the way of managing and organizing the professional work.

Keywords: professions, organization, information systems, professional work, aircraft maintenance, emergency health care

1 Introduction

Professionalism is a concept that has become increasingly important within society [1], [2], [3], [4]. Professions and their knowledge intensive work have increased in importance, and this work differs from more routine basic work. This development has been ongoing in the last century, where society has been organized more and more towards knowledge as a large source for economic development [5], [6]. People who work within the intensive knowledge based occupations are relatively authoritative in their work making their own decisions within their area of knowledge expertise. Within professions, knowledge is used both as input and media for performing the work, as well as the result of the activities performed. In relation to the immediate context to the work, new knowledge is being created and used [7].

There are increasingly needed requirements for knowledge and competence with more competence development within society. It is clear that work is becoming more knowledgeably intensive and professionally orientated [8]. Technological innovations imply an increased need for human expertise [9]. The complexities within the professional work are increasing, where the work within the different professional spheres can be both life and time critical. Moreover, different types of professions are obvious, due to the educational and work characteristics. In this paper the professional types of T(hing) and L(ife) are used, as these types also can be derived from the different cultures of engineering and caretaking, respectively [10].
Information systems are often seen as debureaucratizing, decentralizing and depersonalizing, and also as monitoring and controlling [7]. Organizations within professional work practices have during the latest years been characterized by an urgent introduction of new technologies and information systems which have caused dramatic changes and which have increased the complexity both within the professional work practice and in the organization of the professional work practice [11], [12]. Therefore it is important to know the organizational prerequisites according to structures, processes and different types of stimuli, as to know about the effectiveness of the knowledge management within and between professions, for different types of professions [13]. An effective knowledge management is about supporting creativity and innovation within processes supporting creation, transfer, integration and use of knowledge within organizations [14].

Professions use information systems to a great extent in their intrinsic knowledge work. Information systems often support the knowledge management within professional organizations. Information systems are often seen as bureaucratic and impersonal, and as monitoring and controlling [7]. Professions are acting within an organizational context, where organizational prerequisites are having an impact on professional work [15], [16]. The intentions the organizations have in order to use information systems also have impact on professional work practices. In the way the organizations are managed, and which possibilities and restrictions organizations are composed of, the different professional work and their use of information systems, are also having an impact on how the different professions are collaborating for use and integration of knowledge [15], [17].

At the same time there are great opportunities in managing and organizing the use of information systems in order to support knowledge processes in different professional activities, the information systems also can cause problems. Thus, the aim of this paper is to analyze the importance of management and organization of T and L-professions respectively, for their use of information systems. The aim is also to derive general challenges according to professionals’ use of information systems, related to the way of managing and organizing the professional work.

2 Theoretical Framework

The concept of professions is introduced, together with the characteristics of organizations that have to manage and organize the complex, creative and innovative professional work. Professionals are using information systems in different ways in their work to perform the complex, and often time- and life-critical work. A huge amount of the previous research on professions is related to the state and the society, thus it is related to the macro level [18]. On the contrary, this paper will take into account professions on the micro and meso level, as the professions and their use of information systems are managed and organized within organizations.
2.1 Characterizing Professions

The concept of profession is used more and more when discussing work in modern society [1]. The meaning and interpretation of the concept has been shifting during the years, from denoting professional collaboration, collegial work, a collective identity and confidence based on competence to emphasizing altruism and the service orientated work. The orientation associated with professions is towards the best for the society or the interest of the society in the background of the authority related professions [19].

Four key factors have been identified by Burrage and Torstendahl [20] as important for the development of professions; (1) the people performing the professional work, (2) users, as people that are going to need the professional work, (3) the state and (4) the universities. It has been increasingly important to add a fifth key factor, forming an impact on the development of the professions. This implies that organizations that are included in the professional working areas are denoted as a key factor [2]. The first four key factors are analyzing the professions mostly on a macro level, though the fifth key factor, the organizations, are useful in analyzing the professions in more detail on a meso and a micro level. Professions are relatively autonomous and independent in their work. The work is often characterized by creativity and problem-solving, this requires that one organizes its own work. The professionals make assessments and decide how their work should be planned, organized and co-ordinated based on their experiences [21]. Starbuck [22] states that a profession has its own collegial authority and a common view. This implies that when someone has received a formal education, training and in some cases the license, she/he will gain confidence to use the knowledge and the experiences in different complex contexts within the area of the profession, and to make its own assessment decisions. In this way professionals have control over their own work, and therefore the impact from external rules is minimized [1]. Introduction of information systems is often seen as having an impact on the professionals’ work because it means that rules, control and monitoring of the work are introduced.

Different cultures have historically evolved within different types of professions, where collective experiences constitute a framework. The cultures help people to develop their own different views and to relate to their own work practices, thereby creating a specific identity within the profession. Different cultures within different types of professions imply that boundaries are created, communities are built and separations between people are made. A professional culture represents a shared experience that others do not have [22]. Alvesson [8] mentions the special occupational culture within each profession. Professions specific cultures could be interpreted as hindering other people from their right to work within the working area. This in turn can have a negative impact on how knowledge is shared and integrated in other people and within other professions. This study takes its departure in characterizing the professions on the micro and meso levels, and specifically within the two different professional types, so called T(hing and L(ife) professions respectively [10]. These two professional types can each be coupled with the engineering and the healthcare cultures, respectively. Both of these professional types are included in the classic professions, as well as lawyers, psychologists and architects [23].
2.2 Organizing professions

There are different organizational aspects having impact on the performance of work in all organizations. Organizational structure, culture, strategy, efficiency and effectiveness are some organizational aspects that are important in professional organizations acting in a complex, as well as time- and life-critical. Information systems during the last decades have had a great impact in organizations in different ways. Costs for communication is decreased, collaboration and coordination of work from different places have been made possible. This has implied that new organizational structures can bridge organizational limitations and create new opportunities to coordinate knowledge [24], [25], [26].

The structure within an organization is the primary mechanism that makes it possible to implement and control activities. This is also due to the prerequisites for the implementation and use of information systems. Formalization and centralization are the two most common dimensions for the structure within organizations. Structure in 5’s, means that an organization can be described by the most fundamental parts in an organization [27]. In order to be more adaptive when unforeseeable problems are emerging, organizations have to be able to support variation in both practical work processes and in the structure [28]. Formalization means to which extent decisions and work conditions are governed by formal rules, by standardized policies and routines. Formalization has a negative impact on spontaneity and flexibility, which are necessary for innovation and creativity and is often leading to that people who will be less willing to discuss, deliberate and engage in different alternative in their work [29]. Though, formalization is facilitating cooperation and collaboration between people in an organization. Use of information systems is formed by the structure and the extent of the formalized interaction [30]. All kinds of use of information systems mean an increased formalization because information systems are requiring any form of codifying of information and knowledge. Formalization of knowledge will lead knowledge becoming explicit, clearly defined, and easily be transferred between people. Unformalized knowledge can on the other side create possibilities for people to perform work activities that are new, complex and are characterized by high uncertainty within decision making.

Centralization is referring to where the decisions are made and controlled within an organization, and to what degree they are concentrated [31]. With decentralization the decision making is distributed [32]. A high degree of centralization is creating a non-involving environment, that risks reducing communication, engagement and involvement in activities within the organization. Centralization can also decrease the production of creative solutions and be a hindrance both for communication and the sharing of ideas in the organization. Management and control in organizations can be exercised in three different ways to a varied extent [33]:

1. Self-control – informal control where the individual control him- and herself
2. Social control – informal control of each other’s work
3. Administrative control – formal control managed by the organization.

Organizational culture refers to shared perceptions, values and norms within an organization [34]. Similarly, Kunda [35] is also emphasizing that culture within
organizations can be seen as common rules, which control the cognitive and emotional aspects of people in the organization. Sense-making processes where people in an organization give meaning to new data and information is coupled to organizational cultures. Cultures can therefore in different levels have an impact on the opportunities information systems got in different work practices [36]. Restructuring of established meanings and perceptions that exist in an organization is seen as a part of an organizational culture, together with decisions made caused by new understanding [37], [13].

Strategy is dealing with the focus on static and dynamic effectiveness. Static effectiveness is about refining existent products, processes and capacity. Dynamic effectiveness is about development of new products, processes and capacities. Within an organization the management has the task to strike a balance between the needs of exploiting existent capacities and the needs of exploring and search for new capacities [38]. The strategic capacity in an organization, together with learning and innovation, will lead to an increased performance [39]. The introduction of information systems and support for the use of information systems are having a great impact on the organization’s strategy. The strategy for introduction and use of information systems is to a great extent governed by economic aspects, often from a resource-based view [40].

New forms for management of public organizations have increased during the last decade. The trend of using the so called New Public Management’s philosophy has implied that management strategies from the private sector have been implemented in the public sector. Within public organizations the activities in that way are imitated from the private sector [41]. This implies that public organizations to a greater extent are focusing on control, measurement and follow-up, often together with economic measures and with orientation on efficiency [42]. Information systems have in this way had a great impact in order to give the management a higher degree of control, measurement and follow-up.

The more information and knowledge that have to be accumulated and integrated in different ways in an organization, the more difficult and intricate it will be to organize such an organization. This implies that an organization that is more difficult to organize also has a higher organizational intelligence. Traditional management and leadership models in not any longer fully aligned with the professional work practices of today [43]. Professional organizations are complex in their nature and require attention of aspects for organization and leadership with consideration to the complex dynamic that is existent and where learning, innovation and adaptiveness are occurring [44]. (Uhl-Bien, et al., 2007). Organization and management have to be creative and innovative because the future cannot be predicted in the operative and practical activities performed within complex work. Olmedo [45] states that the key concepts for these work practices are chaos, conflict, instability, complex learning as well as complex dialogues. Learning and adaptability in unforeseeable situations are characteristics that give success in complex work practices. It is important to have information, knowledge and control in upcoming situations, both from the management perspective and within the practical performance of the work, as well as between [45]. In using many sophisticated information systems within complex work activities, the information systems will also have an important role for the organization of complex environments. Information systems will create structures for
how people perform their work, and how people interact with them. In order to understand the complexity of the relationship between information systems and the organization, we can get an increased understanding of how information systems can be implemented and used [46].

The complexity in the performance of the practical work in a professional organization has to do with striving for trying to combine the unpredictiveness with the emerging patterns that exist. It is important to create prerequisites that favor the occurrence, development and use of methods that support the generation of new ideas and that will increase the intensity of interaction and communication [45]. The challenges that can be derived from adaptiveness to new unpredicted situations can be characterized as needs of new patterns of learning, innovation and behavior. In these challenges problem-solving are included, that require exploration, new discoveries and adjustments, because there do not exist any ready solutions for upcoming and unforeseeable problem [44].

The goal in all organizations should be to use the existing intelligence and creativity so that creativity and innovation can flourish. Knowledge and intelligence that encourage creativity and innovation should be able to be communicated and distributed through the whole organization, instead of being limited to be used within specific groups. A strategy that simplifies and rationalizes the management of control structures instead of consolidating fixed boundaries can facilitate coordination and communication. Organization and management within complex and creative work practices need to encourage continual creation and the capturing of new knowledge [44]. To use information systems for communication and distribution within organizations, and at the same time support collaboration and coordination will involve great challenges in professional organizations.

Non-linear thinking, new concepts and ideas, inventions, innovation and creativity is close related to engagement and it need to be better organized in order to be used more efficient and effective [47].

3 Research method

This study has been conducted by using a qualitative approach, as two case studies with ethnological influences. This is an approach well used in studies of the use of information systems within organizations. The case studies have implied that the organizations and the cultures have been studied within a relatively long time period. The data collection has been focused on different ways in gathering information in order to get a deeper insight into the different human, social and organizational aspects within the context of organizations and their cultures. The primary data sources have been interviews, studies of internal documents, observations, informal discussions and participation in meetings within the organizations. When studying their work in the workplace there have been opportunities to see what people do, to hear them explain their work and to get an insight into their routines, dilemmas, frustrations and relationships within their daily work [48], [49]. Documents as e. g. maintenance handbooks, fault reports and medical treatment descriptions have been read. Questions were asked by the researcher, in case if questions would appear
during the observations. The social interplay and the social processes have also been able to study [50]. A summary of the data collection can be seen in table 3.1.

Table 3.1 Summary data collection.

<table>
<thead>
<tr>
<th>Data collection</th>
<th>Aircraft maintenance case</th>
<th>Emergency health care case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observations</td>
<td>Field visits to understand and document activities that took place on site at the air base as well as the emergency unit.</td>
<td>5</td>
</tr>
<tr>
<td>Document analysis</td>
<td>Readings of organizational documents and work procedures</td>
<td>7 days</td>
</tr>
<tr>
<td>Meetings</td>
<td>Project meetings and regular meetings with key members from the actual fields</td>
<td>10</td>
</tr>
<tr>
<td>Interviews</td>
<td>Qualitative interviews mostly focusing on questions relating to apparent themes</td>
<td>25</td>
</tr>
<tr>
<td>Follow-ups</td>
<td>Follow-up discussions where empirical results were reported</td>
<td>2</td>
</tr>
</tbody>
</table>

The interviews have been of a semi-structured character, where a number of themes have been prepared before each interview. The interviews have been conducted in the respondents’ workplaces.

Within the aircraft maintenance the interviews have been done with people from different departments and from different professions in the organization. The respondents consist of flight engineers, control engineers, service engineers, and managers within the aircraft maintenance. Flight engineers are working within the practical maintenance, but there are also flight engineers working as educators and developers at Volvo Aero Corporation (VAC). Developing engineers are working at VAC, and are developing monitoring systems and user interfaces for the flight engineers. Interviews have also been conducted with the developing engineers. In the beginning the study was explorative in its nature, when the research problem was unformulated. The research project was started at the end of 1997, and has continued with more or less intensity until 2010, when the last follow-up discussions were held.
From the practical healthcare activities within the emergency healthcare, different key persons have been interviewed. Doctors, nurses, IT-personnel as well as assistant nurses have been interviewed. An IT-manager and IT-personnel have been interviewed at the IT department as well as interviews with a manager at the emergency transportation department. The respondents represent both the operative and the managing levels in the organization. The research project was started in 2000, primarily as a project where studies of information technologies were important. The last follow-up discussions were held at the beginning of 2010.

The collected material has been reviewed as the study has progressed. The professional cultures and the different professional types have been used as a framework for the analysis. Moreover, the use of information systems has been an overall theme for the analysis. The reviews have resulted in relatively regular reflections and reviews that have been documented. At the beginning of the project there was only a vague understanding about the orientation of the study, that information systems should be studied in relation to the studied organizations. By using the case study research method it has been possible to formulate the design of the research and the research problems. From these different phenomena within the organization analyzes and documentation have been completed. With time the different concepts and patterns have been derived and categorized from the data material, and more specifically have been directed to a research problem [49]. The research problem increasingly turned out to be dealing with the effective use of information systems within professional work practices.

4 Empirical Description

4.1 Aircraft Maintenance

At the time when JAS 39 fighter aircraft was taken into use in 1997, there was a transformation in the maintenance concept, from time-based to condition-based maintenance. The big challenge with this maintenance concept is to strike a balance between cost and risk, ensuring efficient aircraft maintenance when required. Previously maintenance and service work activities were more of a mechanical nature. If any component was damaged it had to be exchanged but to avoid serious breakdowns, the time-scheduled activities were of a large scale. Sensors in the new aircraft gathered signals about the different parameters such as temperature, pressure, height and so on in order to meet the condition-based maintenance concept. Military aircraft maintenance is highly mobile work, very different from the civil aircraft maintenance. The aircraft is often located in different places when it is grounded as the aircraft obviously takes off and lands at different places. There is a need to serve and maintain wherever the aircraft is located. Moreover, the landing place is not always known in advance. This can lead to uncertainty if spare parts and relevant information are not available on that wing or airbase, or wherever the aircraft has been grounded and located in order to carry out the maintenance work. Some information is located in the aircraft, i.e. information about the actual condition of the equipment. Other information, such as the maintenance handbook and rules for
trouble-shooting, are found at the airbase. Due to security reasons there are restricted opportunities to have easy access to data and information by a network infrastructure. In case of war, enemies must not get access to any data or information.

4.2 Emergency Health Care

The emergency department is divided into two departments; each of them located in different hospitals in different cities. The two departments have one common manager. There are several section managers on each department responsible for scheduling, personnel businesses among other things. The emergency department has a medical department, a surgical department and an emergency department for children, ears and gynecology during the nights and weekends. In the clinic, nurses, assistant nurses, doctors and medical secretaries work. Each department has its own IT coordinator that functions as the primary support to the personnel.

There are three people that share the role of IT manager, one of these are also responsible for IT strategy within the NU healthcare and is also a doctor. As an IT strategist he also participates in the regional IT managing group which is supervising the IT director and has the primary responsibility for IT in the region. There is also an IT advisory team that functions as a link between the healthcare management and the IT managers. In this team both practitioners and IT people are taking part.

5 Analysis and discussion

It is common to consider professionalism and organizations as conflicting forces, with a contradictory relationship between authority and expertise [51]. A strong difference is seen between professional work and the organizational context [16]. Therefore, in this respect it is important to clarify the existent differences. Prevalent professional work practices within organizations are nowadays to a greater extent characterized by governing and control. Principles that are guilty for professional work is generally considered as wholly different compared with the principles for management and organization within organizations [16].

5.1 Organization and control

The professions’ position is generally considered as weaker, in comparison with management and organization, and the management is often perceived as a kind of opponent of professions. Management is seen as carrier of organizational reforms and control. Thus, professions are often seen as opponents to organizational control, and that they often are defending their own values [16]. Control means any form of influence that are exercised, intentionally or unintentionally, of individuals, over themselves or over other groups of individuals [21]. A general view is that management and organization of professional work is decreasing the professions’ own power and authority, but it also gives incentives for the professions to reach an
own control and minimizing of risk in their work [16]. It is more required in organizations that the professional work is more transparent and that it could be judged objectively [21]. This is an argumentation that could in various degrees be coinciding with the professions studied. The differences found related to organization and control is presented in table 5.1.

**Table 5.1.** Differences between T-professions and L-professions concerning characteristics related to control, within organization of professions.

<table>
<thead>
<tr>
<th>T-professions</th>
<th>L-professions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stronger awareness of control</td>
<td>Weaker awareness of control</td>
</tr>
<tr>
<td>Stronger awareness of risks</td>
<td>Weaker awareness of risks</td>
</tr>
<tr>
<td>Organizational control</td>
<td>Individual and social control</td>
</tr>
<tr>
<td>More control by professional hierarchy</td>
<td>Less control by professional hierarchy</td>
</tr>
<tr>
<td>More formal and systematized control</td>
<td>More informal control</td>
</tr>
<tr>
<td>Rulebased control</td>
<td>Control based on social relations</td>
</tr>
</tbody>
</table>

The T-professions have a stronger awareness about control than the L-professions. This condition is also characterized by the culture found within the T-professions, where quality and quality assurance traditionally is very important within the engineering culture. Within the L-professions they rely to a great extent on the knowledge and the competence each individual within a profession is held. These differences in the view of control also have an impact on the risk awareness, where T-professions traditionally are more aware of risks than L-professions. This phenomenon has been found in this study, and it is also confirmed by Nguyen [52]. This difference between the professional types is shown in the daily work, where the T-professions all the time are very careful in investigating and documenting as much as possible. The L-professions more seem to see documentation and control as too time consuming, taking time from the ordinary work tasks.

The control within the T-professions is to a great extent based on organizational control [33]. There are predefined rules on how to perform the maintenance and the trouble-shooting work, and they are not allowed to deviate from the rules. There could also be find a kind of collegial control in some cases, when for example more experienced flight engineers are working together with less experienced flight engineers. This would offer the less experienced to ask about advices from the more experienced flight engineers. The control within the L-professions is based on individual and collegial knowledge and competence. Of course there is also an awareness of risks within the L-professions, as faults can be reported by both patients and professionals to Socialstyrelsen (The Swedish National Social Board). Individuals within the L-professions are mainly relying on their own knowledge and competence. They have also the opportunity to discuss with colleagues before they make decisions.
Collegiality within professions is more or less obvious within both of the studied professional types. Bourgeault, et al. [12] also think that collegiality is something natural within professions.

The hierarchy between the T-professions is to a great extent used for control, where professions higher in the hierarchy have the opportunity to exercise control of the professions in the lower hierarchies. The form of control based on hierarchy does not exist within the L-professions in the same way.

The control within the T-professions is formal and systematized. This implies that the control is explicit by systematized rules, follow-ups and tests, which have to be performed within the aircraft maintenance. Within the L-professions the control is more informal. Individuals within the L-professions manage to a great extent if they would exercise any control in their work, and in that case there are different follow-ups and tests that could be performed. The L-professions are more authoritative in making decisions if the follow-ups and tests are to be done. However, the health care organizations have started to implement information systems for deviations management. L-professions perceive that it is disturbing their work and time-consuming to report emerging deviations. It could also be difficult to follow up deviations and to give feedback to the work activities. From another perspective it can be perceived that there are incentives for L-professions to use information systems for deviations management, caused to their own self-preservation do not want to make any faults in their work. Therefore, these information systems can be interpreted as supporting the L-professions work [1].

Each professional organization is characterized by its own approach for control, which can be based on the market, rules, culture or social relations [21]. Within the studied professions, control can be seen as more incused of social relations within the L-professions.

5.2 Organization and Culture

Culture within organizations has a great importance when it comes to how the organizations are relating to the individuals working within the organization, when they are dealing with changes and how learning is dealt with, and also which values that are existent within the leadership level on how the work should be performed. Culture is denoted as the key to reach a distinguished and superior organization, and is built on general assumptions, that have been developed in order to manage external adaption and internal integration [34].

Visible artifacts within an organization are showing what visible values exist within the organizational culture. The visible artifacts can for example be cloths, physical design and technology. The more invisible values can consist of what people think about different conditions and factors and about causes to why some values does exist, as well as underlying assumptions which have an impact on the behavior in the organization [34]. The bureaucratic culture has an impact on professions, and professions are having an impact on organizations [12]. Differences between the different professional types have been identified related to the culture within the professional work practices, and are presented in table 5.2.
Table 5.2. Differences between T-professions and L-professions according characteristics related to culture, within organization of professions.

<table>
<thead>
<tr>
<th>T-professions</th>
<th>L-professions</th>
</tr>
</thead>
<tbody>
<tr>
<td>High secrecy</td>
<td>Low secrecy</td>
</tr>
<tr>
<td>Fear of competition</td>
<td>Not sensitive of competition</td>
</tr>
<tr>
<td>Closed for the public</td>
<td>Open for the public</td>
</tr>
<tr>
<td>No distribution of information</td>
<td>Distribution of information</td>
</tr>
<tr>
<td>Organizational learning</td>
<td>Individual learning</td>
</tr>
<tr>
<td>Rule-based control</td>
<td>Control based on social relations</td>
</tr>
</tbody>
</table>

The T-professions in this study are working within a military organization where a relatively high secrecy is obvious. Often T-professions are working within high-technology organizations where industry secrecy should not be revealed. T-professions are generally a certain fear of competitiveness. They are working with new technological artifacts under development, and therefore they are not so willing to talk about their work. They do not want their competitors to get any secret information. Often those organizations are closed for the public and people from other organizations, with a relatively rigorous control of visiting people. The public is often not directly involved in the work performed by the T-professions. This is also due to the T-professions within the aircraft maintenance. Information within the T-professions work practice is normally not public, in contrast to information related to the L-professions, with the exception of patient-related information. Activity plans and budgets for the L-professions work practice are often available on the Internet. The T-professions organization is a lot more restrictive in using the Internet. They are not using Internet-based information technology for the distribution of information about the aircraft and the maintenance. L-professions do not have any secrecy aspects to consider, without all the patient-related information. Though, L-professions are relatively open concerning their organization and the work performed. The health care is often collaborating in different forms, between different health care organizations. L-professions are naturally exposed for the public. Hence, they are of service for the public in all health care affairs.

Organizational learning from a hierarchical perspective is prevalent within the T-professions’ organization. Individual knowledge and competence are not so obvious and observed. New instructions and descriptions are imposed top-down into the work practice. No feedback, as ideas or suggestions, is requested from the work practice. Within the L-professions the individual knowledge and competence is highly valued. However, within the prevailing trend with quality indicators and deviation reports within L-professional organizations there is now a higher demand on learning on the organizational level.
5.3 Organization and Structure

Organizational structures are closely related to professional work practices. The structures will have an impact on the professions and their work [16]. Organizational structure is focused on the division of work and how the work is coordinated and performed [27]. How professions affect the organizational structure is to this point relatively disregarded within the research [12]. Differences between the T and the L-professions according to the characteristics related to structure, within professional organizations are presented in Table 5.3.

**Table 5.3.** Differences between T-professions and L-professions according to characteristics related to structure, within organization of professions

<table>
<thead>
<tr>
<th>T-professions</th>
<th>L-professions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher degree of structured work processes</td>
<td>Lower degree of structured work processes</td>
</tr>
<tr>
<td>Higher degree of formalized and structured routine descriptions</td>
<td>Higher degree of informal and unstructured routine descriptions</td>
</tr>
<tr>
<td>Higher degree of management of the work</td>
<td>Lower degree of management of the work</td>
</tr>
<tr>
<td>Higher degree of centralized decisions</td>
<td>Higher degree of decentralized decisions</td>
</tr>
<tr>
<td>Higher degree of centralized responsibility</td>
<td>Higher degree of decentralized responsibility</td>
</tr>
<tr>
<td>Organizational division based on different professions</td>
<td>Organizational division based on medical orientation</td>
</tr>
</tbody>
</table>

Within the T-profession the work processes are well structured in standardized routines. The work processes are structured in different documents, as descriptions, instructions, rules and work orders. Work descriptions are formed as rules, procedures, and trouble-shooting schemes. Even if such standardized and formalized descriptions are most used within more simple routine-based work practices, these are used within the T-professions’ work practice. The L-professions have less structured work processes, where each individual can govern his or her own work. Obviously, the L-professions’ organization is flourishing with many different documents, as descriptions, instructions and health care plans. But the L-professions are only using these documents when they can see that there is a need. There are many descriptions of different types, actually there are so many that it is very difficult to have any comprehensive overview of them.

The work practice for the T-professions are more governed and managed by managers. Managers for each of the flight base are managing and dividing the work, and they are authorized to make decisions about which aircraft and as well work tasks should be prioritized. The manager also has control over when the time-based
maintenance of the aircraft should be performed. In this way there is a relatively centralized decision making within the organization. Professions higher in the hierarchy within the organization have higher authority in making decisions than professions lower in the hierarchy. With the centralized decision making a more centralized responsibility is following. The L-professions’ work is less governed by an organizational management. At an emergency health care department it is obviously hard for the management to plan which work tasks to perform. In reality the nurses have the responsibility for planning the work in order to do priorities between different patients that are coming in emergency to the hospital. Hence, the decision making is decentralized to the nursing profession when it comes to planning and prioritizing of the work. The physicians are deciding by themselves within their respective area of responsibility. This implies that the decision making is decentralized also for the physicians’ profession.

How different departments within the professional work practices are organized differ within the different professional types. The T-professions are organized from which profession they are belonging to, at each flight base. Additionally, there are different flight bases, both at the same geographical place at Såtenäs, but also at different geographical places in Sweden. Flight engineers are working on each flight base, and have not any collaboration with flight engineers at other flight bases. The other T-professions are placed at other departments in other building at each flight base. Though, the L-professions are organized based on the medical orientation. This implies that the L-professions are organized at different departments, such as medicinal, surgery and immunology and infection.

5.4 Organization and Strategy

An organization’s strategy is decided by the management on the highest level and will imply that the plans are decided on how the organization should achieve its goals. Within the strategy it is decided which activities that should be performed within the organization, and which resources are available for the activities [27]. Differing characteristics that can be related to the strategy within the different professional types are presented in table 5.4.

**Table 5.4.** Differences between T- and L-professions according to characteristics related to strategy within organization of professions

<table>
<thead>
<tr>
<th>T-professions</th>
<th>L-professions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decreased activity</td>
<td>Increased specialized activity</td>
</tr>
<tr>
<td>Large focus on control and follow-up</td>
<td>Increased focus on control and follow-up</td>
</tr>
<tr>
<td>Decentralized decisions about IS</td>
<td>Centralized decisions about IS</td>
</tr>
<tr>
<td>Based on organizational knowledge</td>
<td>Focus on an increased organizational knowledge</td>
</tr>
</tbody>
</table>
The Swedish defense has during the later years the strategy to decrease its activity, due to political decisions. These decisions also will affect the Swedish Air Force. It has not been possible to receive that many aircraft as planned. There is also a pressure within the T-professions to perform their work as efficient as possible and at the same time maintain the safety. Within the L-professions the health care tends to be more specialized. It has been difficult to find competent professional people for the specialized health care.

The T-professions’ work practice has its strategy ready, as not rely on individual knowledge, and not deviate from existing and approved descriptions and instructions. This strategy is somewhat frustrating especially for the flight engineers, because they would like to use, and also develop, their knowledge and their competence. The strategy for the L-professions work practice will imply increase of follow ups, registration of deviations, qualitative follow ups and management of quality indicators. This situation the L-professions perceive as somewhat unnecessary, when they at the same time perceive that they obviously not have any feedback to their work practice.

The information systems used in the T-professions’ work practice are perceived as well integrated in their work tasks. Within the Swedish Air Force during the later years there is a concentration on influential user participation by the professions. On the contrary, within the L-professional organization the strategy has been to coordinate all information systems related activities to a separate IT department. The IT department is now responsible both for the procurement of standardized information systems as well as support for the information systems in use within the work practice.

7 Conclusions

Leadership and management in the two professional organizations are differing concerning organizational control, culture, structure and strategy. T-professions are more conscious of control, and control is more rule-based for them, compared to L-professions. The control within T-professions is also more formal and hierarchical than within L-professions. The organizational learning is the most important aspect in T-professions, in comparison to L-professions which prioritize individual learning. The organization in T-professions is based on different professions, whereas the organization within L-professions is based on the medical orientation. Thus, the organization in T-professions is more structured, formalized and centralized, than in the L-professions’ organization. Though, the development and use of information systems in the T-professions, are different from the L-professions’. In the T-professions, it is more decentralized, more users participative and thus more based on the real work processes. The challenges for the use of information systems are faced most within the L-professions. In order to receive higher user participation, a higher trust to the information systems, and a more evident sense-making of the information systems can be made. In this way, the L-professions can reach a higher engagement in
both developing and using information systems for the performance of their work tasks.

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Supporting Usability Engineering in Small Software Development Organizations

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Abstract. Despite an interest and use of different usability engineering methods small software development organizations find it challenging to implement usability engineering into the software development process. We present the results from a study about usability engineering in practice. Through a series of semi-structured interviews we want to get an understanding of how usability is implemented into the organizations and how it’s practiced in reality. We found that the developers found it problematic to combine agile software development methods with classic usability engineering methods. A lack of solid usability engineering expertise and not least experience seems to be a main obstacle for a successful implementation of usability engineering into current software development practices. They are requesting methods and procedures that fit better with their current practices and strategies to implement usability engineering into the organizations.

Keywords: Usability engineering, software development

1 Introduction

Usability Engineering continues to be an essential part of software development but it’s not straightforward to combine usability engineering with software development. Usability is an ambitious concept that goes by many names with no clear tangible definition [1]. Usability evaluations needs to be conducted with a clear objective, otherwise it’s a waste of resources and can even become counterproductive [2].

Through a survey Bak et al. looked into the obstacles for deploying usability evaluations in software development organizations. They found that the most significant obstacles were missing knowledge and competences about conducting usability evaluations, the resources required for successful evaluations, and problems with developers neglecting usability perspectives [3]. Several studies have pointed out that small development organizations rarely hire usability specialists or external consultants due to the costs involved [4]. Other studies have found that usability practitioners rarely
follow a systematically approach when conducting evaluations [5] and usability evaluations are analyzed informal and according to light-weight and home-brewed approaches [6]. As a result the quality of usability evaluations is often questionable [7].

In this paper we present a study about usability engineering in small software development organizations. We found that usability engineering is a concern and to some extent a priority, but primarily a lack of competences and a theoretical founded approach stop these organizations from taking full advantage of the benefits of successful usability engineering. Hiring a dedicated usability engineer was not feasible for several reasons, mainly the size of the organizations did not allow for such an investment. As has been documented in the past usability engineering is not straightforward [8]. This especially holds for mobile usability engineering [9]. Identifying and categorize usability problems requires skills and expertise [10] so it’s not surprising that small organizations find usability engineering challenging.

We also found that the use of agile software development methods was a common obstacle as the organizations found it difficult to combine classic usability engineering methods with agile development methods, for example, Scrum. New development patterns and requirements, especially development models based on agile software development, cannot easily integrate with conventional usability evaluation methods and practices. Instead new practices and not least new ways of planning usability evaluation and user experience design are required [11] [12].

Explicate the need of usability evaluation to the customer was also a challenge. Were usability engineering mainly, if not only, has been focusing on the given users of a system, it has been suggested that understanding the business goals behind the system also can be beneficial [13]. A more explicit focus on business goals might make it easier to involve the customer and improve the product.

We believe this research can be of interest to both the scientific community and practitioners, especially small software development organizations. The scientific community has requested more research about how usability evaluations are conducted and analyzed in practice [6] and research has suggested that practitioners can benefit from more systematically and formal methods for both conducting and analyzing usability evaluations [5]. With this study we wish to take a step towards the development of usability engineering methods and practices that can support small software development organizations. This papers serves as an introduction to get a better holistic view of usability engineering in practice. Were other papers have focused on how usability was done in general, this paper specifically looks into small software organizations operations within the agile development umbrella.

With the study presented it’s the intention to get a broad understanding that can be used as a foundation for more focused studies.

2 Background

Several studies have recent years looked into usability engineering from different views including training software developers in usability evaluations [4], how usability evaluations are conducted and analyzed by practitioners [5–7] and new ways of
integrating usability engineering into an agile development process and environment [14]. Recent research has looked into different approaches towards easier implantation of usability engineering in the software development process. This include studying the effects of training software developers in conducting user-based usability evaluations [10], [15], [16]. The overall conclusion was that software developers being trained in usability evaluation were able to catch a significant amount of usability problems in comparison to the problems identified by usability specialists. The studies indicated that missing practical experience was the main obstacle for locating more usability problems. Further one of the studies found that the novice usability evaluators delivered incomplete and hard to understand descriptions of the identified usability problems [10].

A few studies have looked into how usability evaluations are conducted in practice, both when it comes to conducting an evaluation and how the data gained was analyzed. Through an explorative study Nørgaard & Hornbæk observed how usability practitioners conducted thinking aloud usability tests [5]. They found that a systematic analysis of usability problems rarely took place and that evaluators not always got a common understanding of essential observations from the test sessions. Further they report that sometimes usability tests were mainly used to confirm known or suspected usability problems. The questions asked by the evaluators did not focus on how to get a better understanding of the usability problems. Rather the questions were aimed towards predicting possible problems. They also found that common challenges for the evaluators included conducting evaluations on incomplete prototypes and limited knowledge about the system they evaluated. Nørgaard & Hornbæk suggests that new tools and methods fitting better into reality are developed.

Through a survey study [6] wanted to investigate how practitioners analyzed usability data. Two third of the respondents reported from usability testing and one third reported from usability inspection. When it came to identifying usability problems the main strategies were observed problems and responses from the users. The main resource for the analysis was “My processional experience” and expertise when conducting heuristic evaluations. When it came to documenting usability problems, descriptions were common and followed mainly a homebrewed format and explained in plain prose.

The context and circumstances in which usability evaluations were conducted are fare form static making the usability evaluators evolve analysis practices and adapt tools and methods according to a given situation. Følstad et al. conclude that tools will have to fit the analysis context, which is “fast-paced”. Another point is that usability methods are not seen as indivisible wholes as the study shows that people work with usability methods and approaches as components. How usability evaluation is done in reality does not cohere with theory. The methods are considered components that can be combined as needed. Both Følstad et al. and Nørgaard & Hornbæk concludes that the analysis process is challenging and only limited literature about how to conduct an analysis exists.

Some research has focused on ways to support novice evaluators. Skov & Stage has presented a one page tool called “usability problem identification tool” [10]. As mentioned identifying and categorize usability problems requires skills and expertise.
This tool is intended to support and stimulate the analytic skills of novice usability evaluators conducting website development in an agile environment without resources and skills needed for more extensive and expertise driven usability engineering. In an evaluation non-experts were all together able to identify 72% of the usability problems identified by experts. On the positive side the non-experts identified almost all critical problems.

Research has also evaluated methods to support practitioners. For instance, Kjeldskov and colleagues have introduced what they call "instant data analysis" (IDA) [17]. This approach is designed to conduct an agile analysis of think-aloud usability evaluation sessions. The overall procedure is to conduct a one-hour brainstorming and analysis session in which the data logger and test monitor discuss and identify critical usability problems. The result is a list of usability problems divided into different categories based on severity. Afterwards the screenshots and notes from the sessions can be used to further document and explain the identified usability problems. With this method the authors want to introduce a quick yet effective method for usability analysis. The claim is that IDA only requires about 10% of the time needed for conducting a full-blown classic video analysis while still catching essential and critical usability problems. The downside is that a classic video analysis will catch more problems and can provide more detailed information about what causes a given problem.

When it comes to documenting and reporting Vilbergsdóttir et al. argue that highly detailed and very structured usability reports are successful [18]. On the other hand Sy argues that within an agile development frame the reporting should be done in a light manner in the form of meetings and presentations [11].

2.1 Agile Development and Interaction Design

Combining agile development methods with different user experience approaches and usability engineering has recent years received attention from the scientific community [14]. Here two case studies have been selected. Both Sy and Budwig et al. have through case studies described the implementation of the interaction design process into an agile development framework [11], [12]. These case studies provide an overview of how agile software development was mixed with user experience design and usability engineering. Both case studies outline the overall strategy they followed and the experiences they gained through the process. In both case studies usability was not considered a standalone discipline. Rather they both considered usability, user experience design and user-centered design loosely under the same umbrella with no strict lines in between.

A defining feature of agile software development methods is that the development process is centered around iterative development cycles and that there is a focus on the creativity of the people as opposed to more strict processes. [19]. Here both Sy and Budwig et al. found the main approach to be strategies that could be used to implement interaction design into these iterative cycles.

Agile development processes are highly feedback driven those completing a frontend design does not make sense. Focus was kept on a few designs at a given time
and usability testing was only conducted in relation to the design parts in the works at the moment. This was by Sy coined “just-in-time design”. Conducting usability testing in this kind of environment was found to be a challenge because only chunks of the design would be completed at a time. A related challenge is that the workflow of a design was impossible to test. The chosen strategy was to conduct quick usability tests with people in easy reach such as internal users. As testing with external users is time consuming and highly resource-demanding tests with external users was only conducted on relative large design chunks. During the final stages of the development actual workflows could be evaluated. This sort of ongoing usability evaluation conducted within strict development cycles are only successful if the evaluators can maximize the information gained from these evaluations.

Based on the case studies it’s concluded that by conducting usability testing within an agile development framework it has been easier to act upon issues and making changes to the product, but it is challenging to have the interaction design team and the development teams running somewhat in parallel. Designing and coding are two quite different processes and in an agile environment time is always limited. Also while doing design in chunks it’s essential to keep a holistic view, which can be tough in an agile environment. These two case studies clear show that despite clear benefits such as the options to make changes to a design during the development process and faster and less resource demanding usability testing, expertise and focus on method is essential. Both studies report how missing knowledge and experience about integrating interaction design into an agile process caused huge problems.

3 Method

During the spring of 2013 we conducted five semi-structured interviews with representatives from different Danish software development organizations. The number of employees ranged between 4–34 employees making it fair to classify them as small businesses. The overall topic of the conversations was “the interplay between usability engineering and software development”. Each interview was divided into two main categories. The first category of questions was related to the type of products being developed and how the development process was organized. The participants were asked to answer based on actual experiences from recent projects. The second category was about usability engineering. Here the questions were centered around how usability was defined and what purpose usability played during the software development phase. Based on recent experiences the participants were asked how usability evaluations were conducted in practice. By having the participants talk about recent experiences we hoped to get more concordant stories and a broader understanding of the development process that could reveal more about how usability in reality is being conducted. Especially since usability evaluations and considering usability far from always is an explicit state in the development process. The goal with interviews was to get a somewhat holistic overview of how software development took place while keeping a focus on the interplay between usability engineering and software development. The analysis of the data was done according to observer impres-
sion. The data was loosely coded. This coding is partly reflected in how the findings are organized.

3.1 Participants

The participants had several different backgrounds including academic degrees in the areas of computer science and user experience design some had more autodidact backgrounds and one was in charge of quality assurance. Despite that the participants worked in small software development organizations that by first glance seemed quite similar it was clear that there were as many differences as similarities. This was both reflected in the development process, type of products they had specialized in, and the organization of the companies.

4 Findings

All the organizations we interviewed followed some kind of agile development model, formal or informal. Even that several similarities could be located all the organizations had unique routines. This was found to be due to the size of the organizations and because they specialized in different types of products.

The customer is the main priority and the business goals are essential. A characteristic of the companies is that the developers in general have no formal or very limited training in usability evaluation. A common denominator is that the companies had not hired dedicated user experience specialists, but in one case used freelancers for some of the frontend development. A large majority of the development projects are completed within weeks to a few months. Especially this factor is central as such fast-paced environments do not leave much time for traditional usability evaluations. Further resources are limited and it’s a balance between what is requested by a customer, deadlines, demands, and budget. In one company they had received training in conducting usability evaluations but this had not been maintained and the gained expertise was somewhat lost.

The diversity of platforms makes it even more challenging as solutions now have to be accessible from several different platforms, especially mobile platforms.

4.1 Roles

The roles of the developers varied between the organizations. Some developers will more or less take on several different roles. A single developer would mainly complete smaller projects. This depends on the type of projects accepted by the different companies. For example, developing a website for a customer only takes a few people and they will code, design, and evaluate. Were larger projects take up more people and the division between the people involved is stricter. For the small organizations it’s too resource demanding filling out all roles required in a classic development cycle such as the Waterfall model. This was reported as a problem when it came to following a formal agile development approach such as Scrum.
4.2 Usability and user experience

Usability was used a vague term and often mixed with user experience (UX) that also would be used in a vague manner but it was clear that the motivation for usability is there. Usability was to some extent considered as part of the overall design strategy as opposed to a single process task, but when talking explicit about usability the comments would typically be about classic usability evaluation. That being said usability is considered in relation to other design technics such as wireframing, mockups, and prototyping. This is somewhat opposite to some of studies mentioned earlier that looked into evaluation and mainly focusing on the evaluation and analysis of traditional usability evaluation. An umbrella of different methods is used. Again this would be both formal and informal.

What can be called spontaneous usability testing was quite common. This form of usability testing would take place ad-hoc and conducted very informal. For example, by asking a colleague to try out a feature or get feedback on a certain design.

4.3 Explicate benefits of usability engineering

As the customer has the final saying, especially for non off-the-shelf products, it can be hard to persuade the customer into having usability evaluations conducted. Especially explicating the benefits can be somewhat difficult to document and explain. For example, providing measurements of the value of conducting a series of usability testing is tough. Pointing out the exact benefits for a given product was found to be challenging. Usability was often seen as a feature of a product both by the organizations and the customers. Some customers would consider usability testing as “nice to have” rather than considering it as part of the overall development process. Some organizations would also offer usability evaluations as an option. Because they would not have the expertise themselves they would need to get an external consultant and pass the bill on to the customer. As mentioned above some usability engineering is part of the development process, but running final tests with users on a more or less fully functional system and afterwards making adjustments was the big challenge.

4.4 Following good practices

As mentioned usability was considered to be part of an overall design context. Especially developers with multiple roles would mix design and development into one process. Here it’s also relevant to consider that these developers would work more or less independently. Here usability would rely on expertise, experience, and gained knowledge. Typically by following good practices and reuse standards For example, a participant explained about how he had built up best practices over time and was using an abstract model for designing websites so he would always follow some general designs when creating a websites. This included always including certain elements and placing them in certain orders.
4.5 Reporting usability problems

Reporting of usability problems was done in a wide variety, with the common denominator that it was all lightweight. Detailed reports were by some seen as “heavy” material that would not be read by anyone and not fitting in the fast pace of the development environments. In some organizations reporting was not done at all. Rather the developer would rely on quick ad-hoc evaluations and act directly upon the feedback. In other organizations this would be done through short descriptions, for example, in the “to-do” log for the programmers or by short notes and presentations.

5 Discussion

5.1 Usability Engineering in Practice

There is no one solution or direction for usability engineering if one wants to fully take advantage of usability engineering [20]. As advocated by Woolrych and colleagues [21], the focus in usability should be on: “…resources combined within specific approaches…” rather than usability methods as hole units. The context and circumstances in which usability evaluations are conducted are fare form static making the usability evaluators evolve analysis practices and adapt tools and methods according to a given situation [6]. Følstad et al. mentions an idea about using usability methods as components. Sy (2007) talks about “juggle” different designs and evaluations during usability evaluation sessions. The results from this study support these ideas. What is of concern is the potential of increased complexity. These organizations are currently lacking the needed expertise. “Juggling” with different usability resources might even make usability evaluations more unstructured and disadvantageous.

Were Følstad et al. and Nørgaard et al. investigated practitioners without looking into the context they operated in, we specifically considered small software development organizations operating in an agile development community. When investigating usability in practice we believe especially the development framework is essential to take into consideration.

It’s suggested that more research is needed about what usability analysis is, but we also found that in addition practitioners are highly requesting hand-on methods for conducting an analysis, and tools and methods that fits better into their current practices. Rather than methods this could be guides or approaches as seen contextual design such as the book “Rapid Contextual Design” [22].

The case studies presented by Sy and Budwig et al. are both conducted at large organizations. Directly exporting their experiences and suggestions to small software development organizations is not a feasible solution. The size of the development teams (sometimes just consisting of a single person) and that the developers can be assigned multiple roles, for example, both being the designer and developer inquiry different approaches. The organizations simply do not have the resources for full-blown agile developing and design teams. Further the projects are often of a size that
cannot justify large development and design teams. Rather a selection of different components could be part of the solution.

5.2 Secure the investment

Ordering a piece of software is an investment and usability engineering can be considered one of several approaches to secure the investment. If the software is unusable by the desired target group it’s not a safe and good investment. Here usability engineering should be considered part of quality assurance and the target group should be an explicit and essential constant during the process. Again usability is not only a figurehead that simply should be considered a last step or add-on.

Defining a target group from the beginning can turn out to be very helpful usability wise. This is one view on usability engineering that can be used to define and explicate usability engineering in software development projects. Here the organizations need to consider usability engineering from different views and as more than evaluations. This especially applies to the quality assurance of a project and can help keeping a project on track by continuously considering a predefined target group. Potentially a better understanding of what usability is will make it clearer to the customer what usability engineering is and why it’s something that can be worth investing in.

5.3 The Complexity of Usability Engineering

In Brooks’ famous essay “Silver Bullet: Essence and Accidents of Software Engineering” [23] he talks about “essential complexity”. That is the complexity, which is a result of the problems to be solved. Conducting usability evaluations in an agile development environment does not mean that the degree of complexity changes. Rather the outcome should have more value. Lightweight usability methods and tools do not imply cutting corners, and should not be interpreted this way, the complexity of usability engineering remains. Rather it’s about having the right usability engineering tools and methods for the given development model, in this case agile software development models. Here the so-called lightweight methods seem to fit better into the agile development concept in comparison to more classic usability evaluations. Rather they could be more useful and simply provide more insights resulting in better products. The focus needs to be on the outcome and better integration with the overall development framework. It’s about improving the quality and usefulness of usability engineering. A promising approach is explicit integration of UX in the development cycles [11], [12], but to be able to do this specific methods needs to be in place. This introduction study shows that for small software development organizations methods supporting an ad-hoc approach mixed with lightweight approaches not requiring a complex usability lab infrastructure could highly improve the incentive to conduct more structured and higher qualitative usability evaluations.
6 Conclusion

Especially the variety of platforms and the popularity of agile development methods have changed the landscape of usability evaluation. To some extent usability evaluation has to be rethought when it comes to productive and useful usability evaluations in an agile development context. This is both backed up by the case studies presented earlier, and through the results of this study. Using quick methods while explicit focusing on maximizing the output of usability evaluations should be the aim. An approach could be somewhat strict guidelines and efficient methods. The word “guideline” is used to reflect flexibility as we also found that different organizations operates different, the nature of the projects are different, and even that they all organizations followed some sort of agile development approach, they still have unique routines.

The resources, both when it comes to hiring dedicated designers and usability evaluators and expertise are limited. The organizations highly lack experience and expertise. It’s also quite clear that simply hiring designers is not necessarily the one and only path to walk. Integration of usability engineering into the development process is not a straightforward task, yet this could be one approach to integrate more formal and useful usability engineering into small development organizations. Flexible tools and approaches seem to be essential. It’s suggested that approaches focusing on the fast-paced nature of these organizations is used for development of new usability approaches or modifications of existing ones.

When studying usability in practice context, product types being developed, the development method and the size of the organization needs to be considered.

7 Future Work

Were the majority of past research has looked into single usability test sessions, typically some form of think aloud usability evaluation, we want to focus the research on a holistic view of the integration of usability engineering into the software development process. As mentioned only very few studies mention anything about the development model used, a parameter we believe is very essential, so we will specifically consider usability engineering in an agile development environment. Based on the study we believe that small software development organizations not will benefit much from only getting introduced to, for example, lightweight usability methods such as “instant data analysis”. Instead they should learn how to integrate usability engineering directly into agile software development process and be able to organize and use different usability methods so they can become capable of adjusting the entire development process from project to project. As has been pointed out by several studies, not two software development projects are identical [6], [21] and they propose that research in usability engineering can benefit from case-studies.

The next planed step is to carry out a study in cooperation with an industry partner to gain more insights into the organizational context and what can be done to improve the usability aspects of the software development process. When it comes to a research method and approach an engaged research lens is interesting because the
philosophy of engaged research is both to advance scientific and practical knowledge. Under this umbrella action research (AR) is one proposed approach [24]. AR looks interesting as an overall research model because this model explicit is aimed at understanding an organizational context with the intent to intervene into existing practices. An essential feature of AR is that it’s explicitly constructed to engage collaboration between the academic world and practitioners. This research path could result in development and extension of lightweight methods, a better understanding of how usability problems are solved when identified, and how to better train practitioners in usability analysis. With the common use of ad-hoc evaluations better methods for ad-hoc evaluation could be useful for practitioners.

References

Social Media in IS literature: exploring an avenue of Research

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Abstract The phenomenon of ‘digital living’ is to a high extent influenced by the introduction of new media into society. Especially, social media are affecting the digital world of today and are setting the agenda for social connectedness in private, public and commercial networks. Based in an initial desire to explore a research agenda for the workings of social media in network structures a look into the literature on social media within the field of Information Systems sparked an interest in exploring a new research perspective for social media. Reviewing the IS literature it is apparent that the perspective of the ‘media’ as an artifact of social media has been neglected in existing literature. Based in this, this paper proposes research possibilities for investigating the ‘media’ of social media as well as some theoretical considerations that could aid the investigation. Finally, potential outcomes of pursuing the possible research area are outlined.

Keywords: Social Media, Media, Research, IS literature

1 Introduction

Networks and network structures for sharing and creating information can be traced back to the beginning of time and transcends all the way to today’s global world. Networks have emerged for many different purposes ranging from networks for storytelling and sharing to networks created for the intent of strengthening organizational coordination and development. With the emergence of technology, the structure and form of networks have experienced certain changes in order to accommodate the use of new technology and application in society. Internet visionaries such as Paul Baran (1926-2011) have described a shift in network structures from centralized to distributed as a result of the new technology and its
affect on distributed communications. These network settings are fluid and recurring developing in many different forms and for different purposes. Networks are in this sense described as a collection of individuals and technologies that are entangled in network structures. In recent years this accommodation has also come to include new technologies such as social media, which are being increasingly applied in both organizations and network settings. As a result social media are afforded abilities by different users and we see how this motivates and creates the basis for use and reuse of the technology as part of the networked structure. In the private sphere, social media have become the platform where people communicate and share information with friends and family. In the commercial sphere, more and more businesses are using social media platforms to be present where their customers are, thereby adjusting their branding and marketing approach as part of an overall social media strategy. In the public sphere, social media are transforming government practices by increasing their openness and transparency to engage with citizens in new ways, and by allowing for consideration of encouragement of citizen participation. Throughout these applications communities for collaboration and information sharing are emerging by the use of technology and in turn seem to be affecting the shaping of technology in order to fit with these new developments.

The co-evolution between individuals and technology in these networks involving social media is being highlighted by the continuous link between “social” and “media” elements. This evolution process has been used to ascribe social media some of its success as the adoption of the technology by individuals is supported through a social element (Shirky, 2008). However, the question still remains as to which mechanisms actually drive the networks evolution and existence. Especially, the rise of more and more technologies that combine information and orchestrate the compilation of different information types and forms increases the need for understanding what the media can in fact do and how it can work together with humans in order to facilitate these processes and workings. The question is to a high extent linked to seeking an understanding of how social media exist within networks as well as which roles are ascribed to the use of social media. Following this outline of the background notions framing the interest in how social media as a concept has been made use of and studied, a literature review is carried out to seek an understanding of how the literature within the field of Information Systems (IS) research has explored social media in different contexts both within and outside networked structures.

2 Social Media Literature

According to Webster and Watson (2002) a look into the existing literature is a way of advancing and framing new knowledge. The following reflects a look into the emergent literature on social media within the field of IS research. The study makes use of a procedural approach for the literature search in order to identify main streams dominating the theorizing and conceptualization of the social media phenomena to date.
2.1 Procedure

The procedure guiding the literature review on social media is based in a three-step approach adapted from Persson et al. (2009). Adopting this approach allows for a structured way of going about researching the existing literature. The approach is chosen to provide a step based approach in order to establish an overview of the literature. The steps are outlined in figure 1. As a first step, a search was carried out on the platform Web of Science using the search words of ‘social media’ and its sub categories as defined by Kaplan and Haenlein (2010) as ‘wikis’, ‘social bookmarking’, ‘blogs’, content communities such as ‘Flickr’, ‘YouTube’, and ‘Slideshare’, social networking sites such as ‘Facebook’, ‘MySpace’ and ‘LinkedIn’, ‘virtual game worlds’, and ‘virtual social worlds’. This search yielded a vast amount of articles dispersed over many different disciplines. As the focus of this study was to look into IS literature the second step allowed the results to be narrowed down by focusing on articles appearing in the ranked journals of the Association of IS basket of eight journals1 from the IS research discipline. This choice of journals was based in my initial interest of scoping my PhD project within the IS research field. As a result, 36 articles were identified. In the third step, the articles were sorted according to relevance based on two main criteria on how they should deal with the search phenomena by 1) directly investigating aspects of the search terms under investigation or 2) making use of the search terms as a basis for empirical consideration. This led to a total of 29 articles that formed the basis for the literature review.

![Figure 1: Outline of literature search (adapted from Persson et al. 2009)](image1.png)

Figure 1: Outline of literature search (adapted from Persson et al. 2009)
For the literature review, the selected articles were explored drawing on Webster and Watson’s (2002) organizing framework, which they refer to as the ‘concept centric approach’. Central to this approach is the organization of articles according to the concepts that dominate the articles and by creating an overview through clustering those articles that deal with similar concepts together to explore the division of the literature (Webster and Watson, 2002). This procedure was adopted in order to identify the main streams of research found within the social media articles. From this three central streams emerged.

### 2.2 Three Streams of Literature on Social Media

In the literature, three central patterns seem to emerge in the investigation of social media. The first stream identified, explains and investigates patterns for use of social media. Within this stream of literature authors such as Butler and Wang (2012) and Koch et al. (2012) put emphasis on investigating the boundaries that form the use patterns both in terms of the blurred boundaries that the use of social networks create between work life and social life (Koch et al., 2012) as well as the so-called content-boundaries that are constantly being shaped and reshaped by the users (Butler and Wang, 2012). Other authors within this stream focus on the vulnerability of social media use patterns in that the media are so dependent on the users’ continuous engagement in order to become successful (Wagner and Majchrzak, 2006; 2007; Rans et al., 2012). The use patterns of different social media platforms are highlighted by the structures that must be in place for different types of platforms to become successful such as blogs (Silva, Goel and Mousavidin, 2010) and wikis (Wagner and Majchrzak, 2006; 2007; Diaz and Puente, 2012). One structure that is highlighted as the driver for a use pattern in relation to virtual worlds is Goel et al.’s (2013) notion of how the media afford what they refer to as a ‘socialness’, which makes users maintain their engagement and use. However, Hueng-Nam et al. (2012) also note how the vast amount of choices for social media can affect the use pattern of the individual through the number of personal choice options available.

The second stream of articles deal with investigating interactions among humans and social media, and the effect that these interactions have on continuous use and reuse of social media. Within this stream of the literature several topics emerge to describe the interactions of humans with the social media. Here the impact of users’ engagement with each other through social media platforms receives a lot of attention. Aggerwal et al. (2012) expose how users might perceive negative posts on a company blog with some positiveness as they are free to engage and express their opinions. In another article touching on the same subject, the notion of word-of-mouth is attributed great influence through the use of social media platforms and also deemed as one of the key interactions that produce long term effects (Aggerwal et al., 2012). The notion of impact of social media use is investigated by Sursala et al. (2012) who note how social influence is amplified through the use of social media, in this case YouTube. Dewan and Ramaprasad (2012) support this in their research on how social media impact consumer decision by reshaping music consumption and sharing. They
argue that music producers are forced to re-evaluate their ways of thinking about consumers. The notion of restructuring of business process is also a main theme in Mueller et al.’s (2011) article about how virtual worlds are facilitating new ways for customers to engage and thus challenge existing business models. The authors argue that virtual world interaction resembles that of real life. The comparison between real life behaviors and those that are facilitated by social media is an apparent theme in the article by Chesney et al. (2009) where focus is put on the ‘grieving’ that goes on in virtual worlds. Further, another central theme is that of the shaping of social behavior both in terms of Skågeby’s (2010) notion of ‘gift-giving’ as a conceptual framework framing for social behavior and in Khan and Jarvenpaa’s (2010) notion of the effect of Facebook social event planner on group task behaviors. Zhang and Wang (2012) move on to the notion of contributing behavior in their investigation of the participating editors of Wikipedia’s engagement with the media. Linked to the notions of behavior and social media impact a dominant theme is that of understanding individuals’ motivation for disclosing information through the media. Tow et al. (2010) evaluate how users neglect considerations of the information they are disclosing and thus do not know what they are actually giving up. Moving along these lines Krasnova et al. (2010) make a note of how this exactly willingness of people to engage in self-disclosure and give up information is what makes social media such as Facebook interesting for policy makers and industry players.

A final theme within this stream is that of innovation which is facilitated through users’ application of social media and the increased ease of communication and interaction with each other using those tools (Grey et al. 2011).

The third stream of literature highlights the adoption of social media and why humans choose to either adopt or not adopt the media into their practices. Warkentin and Beranek (1999) investigate how the adoption of virtual world into organizational teamwork is reliant on the establishment of proper training of the individuals. Tang and Gu (2012) add to this through their investigation of incentives for content-contribution and how this is driven by the users’ need for exposure, revenue sharing and reputation. The adoption pattern is also influenced by the notion of moderation and how user perceptions can affect those users’ likeliness to adopt the media platform (Chen et al. 2011). In line with adoption patterns the notion of information diffusion as a driver is highlighted by Cheng et al. (2011) who explore how the diffusion of information in micro-blogging makes for a critical platform for users both in terms of information gain but also information clutter. The notion of conviviality of tools is explored in relation to social media and how the adoption is linked strongly to the ongoing shaping by economic and political forces (Ameripour et al. 2010).

The three streams and their related concepts and articles are outlined in table 1.

<table>
<thead>
<tr>
<th>Stream</th>
<th>Main concepts</th>
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<tbody>
<tr>
<td>BOUNDARIES: blurred boundaries (Koch et al., 2012), content-boundaries (Butler and Wang, 2012).</td>
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</tbody>
</table>
Use patterns of social media

<table>
<thead>
<tr>
<th>Vulnerability</th>
<th>Continuous user dependency (Wagner and Majchrzak 2006:2007; Rans et al. (2012))</th>
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</thead>
<tbody>
<tr>
<td>Media Dependency</td>
<td>Varying use structures (Silva, Goel and Mousavidin, 2010; Borgatti and Halgin, 2011; Wagner and Majchrzak, 2006:2007)</td>
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<tr>
<td>Socialness</td>
<td>Engagement motivation (Goel et al., 2013)</td>
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</table>

Interactions among humans and social media

<table>
<thead>
<tr>
<th>User Impact</th>
<th>Positive and negative meaning (Aggerwal et al., 2012)</th>
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<tbody>
<tr>
<td>Word of Mouth</td>
<td>Influential interaction (Aggerwal et al., 2012)</td>
</tr>
<tr>
<td>Social Influence</td>
<td>Amplified use (Sursala et al., 2012)</td>
</tr>
<tr>
<td>Customer Decisionmaking</td>
<td>Shaped and re-shaped (Dewan and Ramaprasad, 2012), intention to purchase (Animesh et al. 2011), business process remodeling (Mueller et al., 2011)</td>
</tr>
<tr>
<td>Real Life Behavior</td>
<td>Emotions (Chesney et al., 2009), participation (Zhang and Wang, 2012)</td>
</tr>
<tr>
<td>Innovation and Entrepreneurship</td>
<td>Collaboration (Balwin and Von Hippel, 2011), virtual possibilities (Sørensen and Fassiott, 2011)</td>
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</tbody>
</table>

Adoption of social media

<table>
<thead>
<tr>
<th>Training</th>
<th>Teamwork (Beranek, 1999)</th>
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<tr>
<td>Content Contribution</td>
<td>Need for exposure, revenue sharing and reputation (Tang and Gu, 2012)</td>
</tr>
<tr>
<td>Moderation</td>
<td>User perception (Chen et al., 2011)</td>
</tr>
</tbody>
</table>

Table 1: Streams of Social Media literature

The identified streams and the concepts within them show tendency of overlapping within the different texts and thus the division above is designed to function as an overview of main concepts that were discovered in the IS literature. However, what the dominant streams and concepts highlight is a tendency in the IS literature towards a focus on the ‘social’ rather than the ‘media’ when researching social media. Especially, the user-centered perspective dominates the research through focus on what it is that the individuals ascribe to the technology and how they make use of it while to some extent black boxing the media as an IT artifact.

2.3 Identifying Opportunity for Research

The findings from the preliminary study of the social media literature within the field of IS reflect similar notions as to the ones identified by Orlikowski (1996) and Leonardi and Barley (2008) in the way that they describe how technology in organizations have been investigated in existing literature mainly from a user perspective. Researchers within the field of IS research have put focus on how the notion of technology has to a high degree been black boxed to a high extent in existing literature. Orlikowski and Iacono (2001) point to a search for the ‘IT’ in IT research advocating for more theorizing about the IT artifact. In their article on materiality and change, Leonardi and Barley (2008) also note how focus on the social
in the relationship between the material and the social has given rise to a one-sided explanation of how the two influence each other and evolve together. From this an interesting perspective emerges for investigating the co-evolution of the social and the media adopting the IT artifact of the media as the point of departure for the investigation.

3 Framing potential research

Based on the findings from the literature review and the outlined research opportunity the motivation for formulating research possibilities is centered on how we can investigate the ‘media’ in social media. Rather than investigating how individuals are social on media, focus can be placed on investigating the co-evolution of the social and the media by exploring what Orlikowski (1996) refers to as ‘following the media’. The notion of ‘media’ is referred to as the actual media of the social media, for example a blogging tool, Facebook site, etc. The use of ‘social’ is tied to how the media engage in and drive the network in accordance to what role a media platform plays and how it takes part in the co-evolution between the social humans and the media. As outlined in the introduction, an interesting domain for research of this nature is further based on the practice networks for information management that incorporate social media, as the media here is part of a networked structure serving continuously shifting purposes such as information sharing, creating and organizing. In order to look into this notion of how media are social or act in social networks several key areas can be interesting to look into.

First of all, researching what is the role of media as an element in networks involving both humans and technology is something, which can be interesting to investigate. According to Leonardi and Barley (2008) the way in which technologies have transformed information practices has not only provided new affordances but also changed the nature of work itself by challenging traditional role patterns of working networks. This further entails an investigation of how media drive individual behavior and the way in which media can push or motivate individuals to act in certain ways. The role of media requires a look into the character that the social media adopt and which roles media might take on when engaging with users or other media platforms.

Second, investigating the co-evolution of social and media puts focus on a tension that has so far been looked at primarily from a user perspective. Studying this from the perspective of the media allows for a stronger insight into the part that the media take in this evolution process and how the two engage and interact. The processes of evolution and co-evolution between individuals and technology are highlighted by Leonardi and Barley (2008) as a central component in understanding the effects that technology and individuals have on each other. Thus, the highlighting of the connection between the social and the media in social media makes for an interesting concept to investigate as it encompasses both elements.

Third, exploring ways of how to study the media can open up for the development of
new methods for approaching this phenomenon. The exploration of methods can yield a new set of tools for researchers within studies of social media to seek an understanding of the media, not just from the human perspective as seen in previous studies but also from the media perspective which has been subjected to a high extent of black boxing.

4 Theories Informing the Research Framing

4.1 Three Theoretical Perspectives

The framing of the proposed research topics can be further informed by giving some underlying considerations in accordance to the theoretical basis within which my research will operate is found by drawing on certain aspects from the works on ‘structurational model of technology’ (Orlikowski, 1992), ‘digital materiality’ (Leonardi, 2010) and the notion of the ‘medium as the message’ (McLuhan, 1964).

The first underlying basis for the research design evolves around McLuhan’s (1964) notion of the medium as the message. This perspective can be used to explore the basis for putting media at a center stage rather than the content that they carry. In this way, media are allotted the possibility of affecting society through itself as a media and not due to content that is delivered over the media (McLuhan, 1964). McLuhan’s (1964) popular example of the light bulb highlights that although the light bulb does not have content such as an article or a newspaper as a medium, it can still create a social effect; in terms of providing light at otherwise dark night times. In relation to investigating the media of social media this puts forward an interesting reflection on how the media does not create content but has indeed fostered a social effect resulting in news ways of interacting, new as well as new language and behaviors. The idea in McLuhan’s notion of media is that the media have become an extension of our senses and have altered our social world (Croteau and Hoynes, 2003). Different media adopt different characteristics and those characteristics motivate and engage the viewer or user in different ways. A tie can be made between the media as an extension and the point made by Leonardi and Barley (2008) in terms of how the introduction of new media is viewed like the introduction of new technology as something which reworks the balance of our senses and causes us to highlight some at the expense of others. The McLuhan (1964) perspective on media might thus create an interesting angle for looking into the question of how the media become social especially in relation to the characteristics that enable this to happen. Inspiration on how to study the media can also be drawn from the media perspective as the emphasis is on characteristics of the media rather than on the content that processes through the media. The assumptions guiding McLuhan’s (1964) ideas of the medium can serve as an interesting starting point for the view of the media in the investigation by allowing a focus on the media in itself rather than the content which it is carrying.

Second, the research approach will draw inspiration from notions found within the topic of digital materiality. Leonardi (2010) presents an overview of different perspectives on how an artifact can be said to be material through 1) matter, 2)
practical instantiation and 3) significance. Out of these three, digital artifacts fail to gain materiality through matter as the lack of physical presence inhibits this. However, the latter two categories of practical instantiation giving an artifact that translates idea into action materiality and significance in accordance with the dependency of value for features on the significance of them provides the digital artifacts with a material justification (Leonardi, 2010). Digital materiality can thus provide the opportunity to look into media role(s) and how they count in accordance to processes of instantiation and significance as digital materials. In following these characteristics and the role of media, the concepts of performativity (Pickering, 2001) and affordances (Gibson, 1986) are drawn upon from a digital materiality perspective to highlight ways of material objects to matter. Performativity (Pickering, 2001) as a concept put emphasis on the material as something that provide people with the capabilities to accomplish goals which opens up for questions concerning what it is that enables this performativity in used by Leonardi (2010) as a tool within the ideas of digital materiality to explore how the enabling characteristics might change from context to context and media to media. Making use of the concepts of digital materiality, performativity and affordances in exploring the first sub question concerning the role(s) of media can thus aid in providing insights into the role(s), which media can assume.

Third, Orlikowski’s (1992) structurational model of technology will be considered as a central foundation for investigating the co-evolution between media and social. Drawing on the notion of structuration theory (Giddens, 1976), Orlikowski (1992) introduced the idea of studying the ongoing cycles of use and technology adaption that take place in human-technology interaction. The notion that technology shapes and is shaped by human behavior is visible in some of the reviewed information systems literature; however, the point of departure for approaching research within this topic would be the media and how it evolves through the interactions with humans rather than taking the user perspective. This approach is suggested in Orlikowski’s (1996) later work where she opts for studying the media by following ongoing cycles of design-use-modification as a strategy for untangling the relationship between agency, the material and the social as it treats both the material and the social as emerging, evolving and entwined.

4.2 Exploring A Method

The method of investigation could take its outset in the qualitative traditions through focus on observations of the media in order to seek to investigate the notion, which Orlikowski (1996) refers to as ‘following the media’. The challenge here is to refrain from adopting the user perspective by focusing on their actions on the media. Rather, focus would be to investigate the way in which the media accommodate as well as challenge the way in which humans act and interact. Inspired by recent opting in IS research to broaden the reporting of such empirical observations the use of storytelling and narration could be explored in order to tackle the method challenges.
conduct interpretive research should proceed with work by focusing on multiple perspectives of stories and who tells the stories. Based on this it could be interesting to explore the use of different storylines within the media’s interaction with the network and its participants and outline these in order to develop a picture of the media’s influence on the evolution of the relationship between the social and the media. The notion of creating a narrative about media can allow for a more complete and complex picture of the situation and further for the same character or media to appear in different storylines and might lead with it findings of circumstances affect the media’s sociality. Further, outlining the findings in such a way might also enable a study of the intersections between the different stories and broaden the perspective on how these intersections affect each other and why. Kendall and Kendall (2012) note how the basis of storytelling can be found through seeking different sources of inspiration such as interviews, news articles and informal interactions in order to obtain a framing of the story. This implies adopting a multi-method approach where story lines can be informed by different sources pointing in the direction of which stories should be told. Exploring storytelling as a potential method could allow for the description and interpretation of the entire story in terms of increased awareness of the telling and vividness, the purpose of the story and the order of episodes and chapters (Kendall and Kendall, 2012). The storytelling approach can aid in deciphering some of the mechanisms and patterns that emerge in the media’s engagement and actions within a given context. Exploring this approach further could allow for new methods do be developed for how we can carry out such studies of media in an online sphere by exploring the story of the media.

5 Potential Outcomes of the Framed Research

In light of the emerging technological developments and the continuous growth in social media variants and user base, social media have become an emerging field of study but this has to a large extent been from the perspectives of how the users shape and make use of social media platforms. The outcome of the proposed research possibilities can provide a number of potential areas for contributions in line with the highlighted investigation topics discussed in this paper.

First, the look into what roles media take on can provide insight into what part media can play and how it takes part in the shaping and re-shaping of the relationship between humans and technology. Investigating these mechanisms can give an insight into what characterizes social media and broaden the understanding from the views found in the existing literature focusing on social and human roles towards an understanding of the media role.
Second, exploring the co-evolution between the social and the media through following the media can provide not yet established insights into how media affects this process and allow us to explore if these effects actually exist as well as what drives them. The existing focus on the user perspective has, in my opinion, given us valuable insights into some of the reasons for this; however, it can be argued that studying the co-evolution from the media perspective can bring new insight to the social media understanding.

Third, exploring methods for 'how to follow' the media can open up for the creation of new approaches to tackle media studies and in particular to opening the black box of technology which can often be difficult to grasp. Formulations of frameworks for this could be interesting to explore in terms of how the media can be followed both in regards to where to start and which tools and methods can be used to process and work with the empirical findings.

The investigation of social media from a media perspective can allow for the creation of new knowledge about what role and part social media take in those networks within which they operate and exist.

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Desperately seeking the 'IT' in IT Research - A Call to Theorizing the IT Artifact. *Information Systems Research*, 12 (2), 121-134.


Properties of Participatory Approaches for Designing with Children

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Abstract. Information technology in health services has an increasingly important role in people’s lives. However, the design of this constitutes a complex situation in a sensitive context. The complexity further increases when the users are children. Participatory approaches are beneficial for design with children, but there is limited research on how to design with children and how existing methods can be made to suit a health related context. This paper aims identifying common properties of participatory design methods when performed in a health related context. The identified properties of design methods were found to relate to three different categories: activities, designers and participants. To these were added properties of research methods with children in health contexts, where a majority related to the category of designers. This indicates the designers’ responsibilities are particularly important when designing with children in a sensitive, health related context.

Keywords: Participatory design, health, children, methods, properties

1 Introduction

The use of information technology (IT) in health services is an increasingly important part of people’s lives. There is for example a focus on how IT can promote health and improve qualities of life within the Digital Agenda for Europe [1]. However, the design of these technologies presents a complex situation for designers, who have to deal not only with conflicts among users and interests, but also deal with a context which relates to the users’ health and wellbeing – a potentially sensitive context.

Furthermore, when the users are children, additional complexities emerge. For one, children have a different culture than adults, have a lesser ability to communicate abstract thoughts than adults do, and express themselves more in actions than in writing [2]. Also, when the circumstances that are the basis for the children’s participation, for example health related issues, can awaken negative emotions, extra care needs to be taken that the children are not unduly upset or affected [3].

During design it is common to use a method for helping control, handle or understand the complexity of the situation. When designing with children, it is common to use participatory approaches, which are considered beneficial for
designing with children [2], [4], [5]. However, any method that is initially intended for work with adults needs to be adapted to suit designing with children [6], [7].

One of the first to adapt participatory approaches to the work with children was [8], who presents a method for actively including children as co-designers. Since then, a number of adaptations of this method have been made, along with other methods to, for example, create personas and scenarios [9], [10], and prototyping [11], [12]. However, there is still research needed on how children can participate in the design process [13].

The research for this paper was conducted within a project that aims at developing Online Peer Support (OPS) for children diagnosed with acute lymphoblastic leukemia. The project takes a participatory approach, but since the context is health related and of a sensitive nature, it was necessary to find out about the nature of design methods in similar contexts. Therefore, the aim of this paper is to identify common properties of participatory design methods when performed in a health related, sensitive context.

2 Participatory Approaches with Children

The foundation of Participatory Design (PD) is that of democracy; the approach values active and extensive user involvement throughout the entire design process [5]. User-Centered Design (UCD), also a participatory approach, is based on slightly different ideals. The UCD movement was critical to the human factor being ignored in design and development, and therefore advocated a process with focus on users in different ways [14]. Participatory approaches are generally considered to increase the effectiveness of the finished design [14].

In participatory approaches, it is common to use less formal methods and techniques such as prototyping, mock-ups, diaries, probing etc. [15]. Establishing trust among the participants is essential in participatory approaches [16], and the relationships have to be sustainable because the work is often long term and iterative [17]. These kinds of approaches can require great effort from both the researchers and participating users [18].

Participatory approaches are well suited for design with children [2], [4], [5]. Cooperative Inquiry (CI) was introduced by [8] as an approach specifically suited for design with children. CI has its roots in participatory approaches, and children are involved over a long period of time as users, testers, informants and design partners. A number of methods have, since its introduction, added to (e.g. [6], [11], [19]), and been inspired by CI (e.g. [20], [21]). Some examples include [6] who adapt CI for use in an educational context, and [7] who adapt CI to suit design with children aged 4-6 years.

There are many design methods specifically adapted for designing with children, and no generic method appears to exist. Yet, these methods have a number of properties in common. I found that these properties could be separated into three categories depending on what part of the design method they relate to: the activities performed, the designer who prepares and leads them, and the participants of these activities.
2.1 Activities

Something which is often mentioned in the literature relating to design methods with children is that the activities should be fun (e.g. [12], [22], [23]). Activities that are fun are more likely to engage and motivate the children [24]. What each child considers fun is naturally a subjective opinion, but many activities that are usually described as fun are creative, low-tech activities.

Mostly the activities revolve around the use of low-tech tools such as pens, papers, glue, scissors etc. Only a few of the reviewed articles mention the children having used an IT artifact as a part of the activity [25], [31], and then the material was usually supplemented by other, low-tech activities.

The activities should be familiar to the children [23], [28], which is one motivation for the use of low-tech tools. The children are often familiar with them and their use [25]. Some for example use comics in their activities, with the argument that children generally are familiar with the concept [6], [31].

The physical setting where the activities take place varies throughout the literature. Some designers visit the children at their schools (e.g. [23], [25]), while others have dedicated design labs (e.g. [26-27]). A school setting can make children more inhibited and worried about giving a “wrong” answer [24]. On the other hand, schools are familiar to the children, and can make them more comfortable than an unfamiliar setting, and it is also a place where they are easily accessed [26].

There is frequently a “get to know each other” activity at the beginning of the process which is intended to build trust and a relationship with the designers (e.g. [20], [28]). It is also common to have several different kinds of activities (e.g. [29-30]). Varying the activities allows children who are strong in one area, but weaker in another, to participate and contribute in at least one activity [29-30]. It also prevents the children becoming bored or running out of ideas [29-30].

Having physical activities (where the children use their bodies) is not uncommon. A typical activity is acting [23]. This is described as both fun and a way to tell stories without including drawing [23], [30].

There is often a creative element in the activities [20], [25], [28]. This can be, for example, telling stories [20], acting [23], crafts [27], or, most commonly, drawing [26]. The children are allowed to express themselves, and their imagination. However, the downside it that those children who already are creative and expressive give a richer material than other children, and are thus preferred as participants [31].

Giving the children a sense of contribution, and how their contribution has been used, is important [32]. A common tactic is to have summarizing activities at the end of the session [11], [33]. It is also recommended to have a session further on in the development process for showing the children what their work has led to [24].

Not only is it important to give feedback to the children on their contribution, but it is also essential to have them give feedback on the interpretation of the material. When the material has been collected and analyzed, the conclusions should be presented to the children so they can correct anything that may have been misunderstood [34].

Children need boundaries [32], [35]. It has been experienced that children contribute less when they have fewer boundaries [31]; brainstorming has for example been found less successful with children for this reason [33]. Similarly, any
instructions should be very clear, and preferably presented with examples of what is expected of the children [32].

Finally, it is often the case that the activities are lengthy in regard to time [36]. CI is for example particularly time consuming, and children can be members of a design team for years. There have been attempts at reducing the time needed; [26] for example attempt to increase efficiency of workshops by setting up different “stations” that children can alternate between.

2.2 Designers

It is common to prepare several activities that can be flexible as to time [26], [27]. Being well prepared is obviously important, but also providing a structure among the activities, having them follow each other logically and incrementally [21]. If more than one session is conducted with the same children, these sessions ought to be somehow connected [33].

Communication is at the heart of the design process, and any problems that can occur for example with the understanding of instructions can be solved by maintaining an open dialogue [35]. Further, communicating the outcomes of the results can be done in several ways, for example as [20] solved it, by creating videos with the children themselves explaining the results.

Children are no design experts, nor are they meant to be. This means that they may not know what is feasible or what is expected of them [4], [7]. From the start, the designers need to handle the children’s expectations and make them understand what is possible in order to make the design suggestions feasible [7], [5]. However, focusing too much on what is realistic might stifle the children’s creativity [4]. Also, the children should know what is expected of them and the activities they are asked to perform, or they can become upset if, for example, their idea is not chosen for further development [30].

Lastly, children are lower in the power hierarchy and are used to obeying adults. This can make interacting with adults on an equal level as design partners difficult. Therefore, it is recommended to be informal and avoid showing authority when working with children [5], [8]. Further, informal clothing should be worn and an informal language used [5], [37], and if the children are sitting on the floor, so should the adults [11].

2.3 Participants

Children are sometimes described as having limitations in various areas, for example: verbal expression [19], [29]; abstraction [38], [39]; writing [7], [30]; and social interaction [12], [32]. These limitations have to be taken into account when planning the activities. Practical activities are for example more suitable for work with children, rather than talking or observing [25]. Talking in the form of interviews or questionnaires is difficult for young children who are verbally limited, and observation requires interpretation by the designers who, being adults, may misinterpret the children [20]. Limitations in social interaction can make it difficult
particularly for younger children to work in groups, making it advisable to always have an adult present [12], [19].

The difference in the power relations between children and adults can also affect the process [22], [8]. Adults have more rights in society and children are not always expected to take responsibility, and are therefore not given any. Acting in an informal manner can help reduce this discrepancy [5]. In a participatory process, children and adults are meant to be equal partners, and the children have an equal say in decisions and idea generation [8], [10], [31], and should be given the opportunity to exercise that right. However, it can also happen that the participating adults forget that they are equal in this process, and leave it all to the children [33], which is not advisable either. All in all, building trust between the participants is an essential factor in being able to work together successfully [20].

The group setup varies throughout the literature. Children in the ages of 10-11 are considered the best prototyping partners [8], and many seem to prefer including children that age (see e.g. [31], [36]). Some work with large groups, like entire school classes [20], [26], while others set up smaller groups [11], [35], or work with one child at the time [39], [33]. When working with large groups these are often split into smaller constellations, possibly with an adult presence in each [26], [32].

The relation between the amount of children and adults varies; there is often a larger number of children than adults [20], [26]. This may be an attempt to reduce the discrepancy in power relation between adults and children. However, working one child with one adult allows the children to express their ideas and simultaneously make it possible for the designers to document the ideas [39], [33].

Sometimes so called “gatekeepers” (primarily teachers) participate in the design process along with the children [20], [40]. This can have a positive effect because there will be an increased adult presence [25], the children already trust the gatekeepers [26], and the gatekeepers can contribute with their knowledge of the children [7].

2.4 Summary of Properties of Design Methods with Children

Table 1 presents a summary of the identified properties of design methods with children that have been described above. The properties are not necessarily present in all methods, but make up common denominators for design methods with children.
Table 1. Summary of properties of design methods with children

<table>
<thead>
<tr>
<th>Activities</th>
<th>Designers</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-tech</td>
<td>Preparation</td>
<td>Group setup</td>
</tr>
<tr>
<td>Fun</td>
<td>Communication</td>
<td>Limitations</td>
</tr>
<tr>
<td>Sense of contribution</td>
<td>Handle expectations</td>
<td>Power relations</td>
</tr>
<tr>
<td>Familiarity</td>
<td>Informal</td>
<td>Equality</td>
</tr>
<tr>
<td>Time</td>
<td></td>
<td>Gatekeeper participation</td>
</tr>
<tr>
<td>Physical</td>
<td></td>
<td>Trust</td>
</tr>
<tr>
<td>Variety</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contextually unique</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boundaries</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creative</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Since only a limited amount of research on design with children in a health related context was found, these properties thus relate to design methods in general. The next section will detail properties identified relating to other research methods with children in health related contexts of a sensitive nature.

3 Research with Children in a Health Related Context

A sensitive context is defined as one where the topic dealt with can cause emotional or psychological distress [3]. A health related context can fall under this definition, particularly when relating to life threatening diseases. Children are particularly vulnerable to the distress that can be caused by dealing with a sensitive topic since they do not always have the experience to deal with what they have been through [41]. Still, there is limited research on performing research with children when the context is health related [34]. Methods which are used to perform research with children in sensitive contexts have to be adapted from the more “adult centered” methods [42].

The use of proxies can be advisable when the context is of a sensitive nature [25]. A proxy creates a “barrier” between the child and the topic, thus reducing the emotional involvement. Proxies can be in the form of stories or characters; they can be non-human [25], or human characters [31], and can be used stand-alone [25] or as part of scenarios [31].

When designing with children, low-tech activities like drawing and acting are often performed. Similar activities appear common also in non-design research when the context is sensitive (see e.g. [24], [25], [43]). The argument for this is the same as with design methods: that the children understand what is expected of them and are comfortable with the tools [25]. Furthermore, drawing makes it easier for children to talk [43].
Moreover, being and showing patience and care is important when doing research with children [3], [34]. The child should be given time to come up with a response they consider complete [3], and should be allowed to work in silence in order to collect their thoughts [34]. They should also be allowed to choose which activities they want to perform, and it should be made clear that they do not have to do something they do not want to [24]. Therefore, a high amount of flexibility is necessary from the designer, as well as the schedule. There should be enough activities planned so that there is always something to do, but not too many so that the children feel stressed and are unable to do their best. Having different kinds of activities also help making the children more engaged [44].

The power relation between children and adults is, as mentioned above, unequal in our society. There are recommendations for how this inequality should be reduced when designing with children, but also in literature relating to research in a sensitive context. It is for example recommended to ask the children questions [24]. This serves a dual purpose: the children are given the role of “expert” where the adults are the ones the children have to “teach”, thus inverting the power relations; it also improves the interpretation of the material since the researcher’s knowledge of the children increases [34].

Children are not required to give informed consent to participate in a study, but it is recommended from a research ethical standpoint [24], [34]. The preconditions for the study should be explained in such a way that the children can understand them. [24] for example used tape recordings where they orally explained their study in order to make sure the children who did not read well could also understand what they consented to.

Furthermore, the researcher should, when working with children in a context which requires asking personal questions, be prepared to reciprocate with their own personal information and opinions [34]. If the researcher is not prepared to divulge the same amount of personal information as the children are expected to, they are not equals in the power relations either.

3.1 Summary of Properties of Research with Children in a Health Related Context

In Table 1 earlier, the identified properties of design methods with children were presented, organized into three categories. The properties detailed in this section, relating to research with children in a health related context, relate to the same aspects as the properties of design methods, and can thus be organized into the same categories.
Table 2. Properties of research methods with children in a health related context

<table>
<thead>
<tr>
<th>Activities</th>
<th>Designers</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-tech</td>
<td>Communication</td>
<td>Power relations</td>
</tr>
<tr>
<td>Familiarity</td>
<td>Personal</td>
<td>Informed consent</td>
</tr>
<tr>
<td>Proxy</td>
<td>Flexible</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ask questions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Patience</td>
<td></td>
</tr>
</tbody>
</table>

In the summary presented in Table 2 above, the properties of research methods with children in a health related context which overlap with identified properties of design methods with children are presented with italics.

Notably, out of ten identified properties, five relate to the designer. Also, out of these five, four had not been identified as properties of design methods with children. It is thus clear that this is a category which carries particular weight when the context is health related; in other words, the responsibility of the designer increases in such a situation. When a design method is adapted to suit a health related context, a majority of the changes thus need to be made in how the designer approaches the work.

4 Design Workshops with Children with Cancer

The research for this article was conducted within a project aimed at developing an OPS solution in order to promote the mental health status of children between 8-12 years old who have or have had acute lymphoblastic leukemia. The project takes a participatory approach, and an early stage of the project involved five children in the ages of 11-13 in design workshops. Since the children’s participation was based on them having had a serious illness such as cancer, it could cause them to become distressed or upset. Yet, involving those who have gone through traumatic and difficult experiences in research is necessary since they have unique knowledge on that specific topic [3].

It was thus essential to take special care to avoid making the participating children upset. Children are particularly vulnerable to the distress caused in this kind of situation since they do not always have the emotional experience to handle what they have been through [41]. Still, there is limited research on performing research with children when the context is health related [34]. As argued above, one cannot simply apply a method used with adults to the work with children.

In this case, six workshops were performed with five children split into two groups. The first group was made up of three boys aged 11-12, and the second group consisted of two girls aged 11 and 13. The children had been, or were still under treatment for leukemia. Three to four researchers participated in each session. The workshops were based on the concept of comics in order to create a common denominator that permeated all workshops: during the first workshop the children created characters, during the second workshop they drew comics that had these characters as protagonists, and for the third workshops these comics were used as a
basis for discussion and further development of design ideas. Figure 1 below shows an overview of the main workshop activities that the children were asked to perform during the workshops.

![Diagram showing workshop activities]

**Figure 1.** Overview of main activities of workshops

The characters and comics were digitized using an online comic creation application, allowing the children to see their creations as finished comics. Comics are considered to be familiar to most children [31]. Since the deliverables in this case (characters and comic stories) mapped reasonably well with the concepts of personas and scenarios, using comics suited the work well. It was also assumed that by using characters as proxies, instead of the children themselves as a basis when creating these comics, the children would distance themselves from the scenarios, hopefully reducing any distress caused by the context of their participation.

The purpose of the first workshop was to create familiarity within the group and develop the characters that were to be the protagonists of the comics in the upcoming workshops. These characters were also meant to be the basis for the personas which would be used throughout the rest of the design process. The children each worked in pairs with one adult, and with the use of cut-out dolls they came up with for example the characters’ names, what they liked and disliked, and what they were interested in. The boys in the first group were asked to create characters their own age, but during the second workshop we noticed that they spoke about their characters as though they were themselves. Since the intention with the use of the characters was to maintain a distance between the child and the events in the comics, this was not wished for. The second group was therefore asked to create characters a few years younger than themselves in order to increase the disparity between them and the characters. This group proved less inclined to identify with their characters, but this may not only have been due to the age difference of the characters, but also due to at least one of the girls being older and more mature than the boys.

The second workshop aimed at creating possible context scenarios and identifying potential design ideas. A summary of each character from the first workshop was provided, along with the beginning and ending of comics which the children were
asked to complete. This activity was inspired by comicboarding (see [31]). The stories contained aspects that related either to the properties of peer support, or to for example feeling unwell. For each group, four to five comics had been prepared, and the children again worked in pairs with one adult.

The concept for the third workshop differed completely between the two groups. For the first group, the comics which the boys had drawn during the previous workshop had been transferred to a digital format, and had been extended with a scenario where the protagonist(s) interacted with a design suggestion. The design suggestions were based on the results from the analysis of the first two workshops. The aim was to gain opinions and reactions to these suggestions. The scenarios were thus presented to the boys, who were asked of their opinion, if they would use it and if they wanted to change anything. However, it was clear that the boys were not comfortable giving negative feedback. They expressed that they thought the ideas were “OK”, but it was clear that they were not always positively inclined towards them. It was assumed that the format for the workshop, which was based mostly on talking, was the reason why the boys found it difficult. Therefore, the third workshop was changed for the second group.

The aim of the third workshop for the second group was to identify and further develop ideas for one or more mobile applications which could be applied to the OPS concept. Again, the children’s comics from the second workshop had been transferred to digital format. Their comics either did not include a digital artifact at all, or included an already existing application. The children were thus asked how they would change the story to achieve the same result using an application of their own design. They were given templates of smartphones and tablets and were asked to sketch what such an application could look like. The activity suited the older girl very well, but proved difficult for the younger girl. It was, however, an opportunity to further develop and concretize the ideas gained from the workshops.

Finally, after both groups had performed all three workshops, a summative session was conducted where the children and their families were invited to see and listen to the current results from the workshops. The occasion intended both to inform the parents of what their children had been doing during the workshops, but primarily to show the children what they had contributed to and what their contribution had been used for. Since the way of working with comics can seem somewhat abstract in relation to what might be expected from a design process, it was considered necessary to more concretely show the children what their work had resulted in. Besides some analytical material, two low-fi prototypes of mobile applications had been prepared (one based on the workshops with the first group, and one on the second) and were presented to the children and their families. The session also yielded useful feedback from both the children and their parents.

5 Discussion

A health related context of a sensitive nature can cause design participants to be upset or otherwise affected from their participation. Children are specifically sensitive to this. The context in this study was sensitive since the basis of the children's
participation was that they had been, or were still under treatment for cancer. Their participation could thus awaken emotions caused by having a life threatening disease. We therefore had to make sure that the children were not affected in a negative way.

For the workshops conducted within the scope of this research, the group setup for a majority of the work was made up of pairs with one adult and one child. This was found to be a successful format for several reasons. Firstly, working in pairs allowed the adult to keep a close eye on the child and their mood. It was not necessary during these workshops, but the adult could have stopped the work and taken the child aside if anything had occurred to upset them. Secondly, working in pairs allowed all children to express their opinions to an equal degree; no single child dominated the discourse, but all had the opportunity to make their voices heard. Thirdly, it proved to be an efficient way of working since the adult could keep the child focused on the activity. Also, when working with the characters and comics, the pair could for example discuss the character’s personality while the child was drawing, thus both allowing the child to spend as much time as they wanted on the details of the character’s appearance while still keeping up the work.

The use of proxies can be advisable when the context is of a sensitive nature [25]. During our workshops with the children we used characters of the children's own creation as proxies. The assumption was that with the use of comics instead of the children themselves as the protagonists of the comics, they would be distanced from the events of the stories. However, the first group clearly identified with their characters, and several times referred to their characters as "I". To counteract this, the children in the second group were asked to create characters that were younger than themselves. This resulted in it becoming more difficult for them to create the characters and stories, since they expressed that they did not know what children younger than them liked. We felt that the children in the second group had been better able to keep a distance with their characters even if they had been their own age. The use of proxies is thus a matter of balancing the children’s abilities with the distance wished for to the proxies. In a sensitive health context it is not advisable that the children identify too closely with the proxies, but if they are too distant from the children, they will not be a useful tool for design.

Using low-tech activities such as drawing is very common when designing with children. It is considered more appropriate than using interviews, which is more difficult for children than for adults, particularly when the children are very young [20]. The third workshops for the first group mostly consisted of the children giving verbal feedback on ideas presented in comic form. The group had participated with much enthusiasm in the previous workshops, but found it difficult to express their opinions in this way. They were particularly careful with expressing negative opinions. We reflected after the workshop that a more active and creative format had been better, and adapted the workshop for the second group accordingly. That workshop was considered more successful.

As recommended in the literature, the activities during the workshops were planned flexibly as to time and how they were performed. One of the boys for example did not like the ending of one of the comics he was asked to finish in the second workshop, and was thus allowed to create his own ending.

The participating adults also had to be flexible in their role. Some of the adults for example wrote and talked with the child they were working with, while the child was
drawing, to make the work progress faster. As another example, one adult was instead asked to draw by one of the children who did not have the energy to draw anymore, but still wanted to keep going. At other times, some children needed a high degree of guidance, while others preferred to work independently.

In a health related context, the participating adults should be prepared to reciprocate with the same level of personal information as is asked of from the child [34]. During the design workshops, the children simply seemed to assume that the adults would give the same kind of information as they did. They for example cooperated with the adult in the creation of their characters, asking what kind of hobbies we had, and incorporating these into their characters if they found them appropriate to the character in question. There was no noticeable hesitation on the children's part to ask for this reciprocity, and the adults were prepared to share their information, just as they asked the children to do.

6 Conclusions and Future Work

The aim of this paper was to identify common properties of participatory design methods when performed in a health related context. Properties of design methods with children were identified from a literature review. These were separated into three areas: the performed activities, the designers and the participants. Further, properties of research methods with children in health related contexts were identified and separated into the same categories. It became clear that many of these properties relate to the designers, wherefore it is this category which must be the primary focus when a design method for design with children is adapted for a sensitive context.

| Table 3. Properties of design methods with children in a sensitive context |
|-------------------------------------------------|-------------------|---------|
| **Activities**                                  | **Designers**     | **Participants** |
| Low-tech                                        | Preparation       | Group setup   |
| Fun                                             | Communication     | Limitations   |
| Sense of contribution                           | Handle expectations| Power relations|
| Familiarity                                     | Informal          | Equality      |
| Time                                            | Personal          | Gatekeeper participation |
| Physical                                        | Flexible          | Trust         |
| Variety                                         | Ask questions     | Informed consent |
| Environment                                     | Patience          |               |
| Contextually unique                             |                   |               |
| Boundaries                                      |                   |               |
| Creative                                        |                   |               |
| Proxy                                           |                   |               |
Table 3 presents a summary of the properties of design methods with children in a health related context. This is also a summary of the contribution of this paper. These properties can function as guides for anyone intending to design with children, particularly when the context is of a sensitive nature. However, more work still needs to be done relating to how children can participate in health related research, as the need for IT in health care increases. More extensive studies can be made, as well as studying whether there are properties that are more essential than others, and how to combine these properties in order to achieve the best conditions possible for the children.

References


Phone or Web?
Conditions for self-service and autonomy when doing tax

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Abstract. A democratic information society for all will need to provide public services that maintain and possibly enhance citizens’ mastery of their own affairs. This paper analyse the questions to a public agency call centre from the viewpoint of the non-users of the online services. The communication between the call advisors and the citizens is analyzed according to the framework of Star and Ruhleder [1]. First level issues can be solved with fact-oriented information from the advisor. Solving higher level issues will require addressing and handling unexpected or contextual issues. We discuss the implications of this analysis for the design of web pages and online services. First level issues can be satisfactorily solved by information on the web pages, while online support for higher level issues will provide a design challenge.

Keywords: e-Government, autonomy, tax, three levels of communication

1 Introduction

In the interactive information society web pages and automated services are to an increasing degree the face of government towards its citizens. For democratic reasons the information society will need to maintain and develop the citizens’ mastery and autonomy of their personal affairs in their use of the public online services. However, little is known of how well existing services today function for the citizens and how the citizens experience their use. In Norway public websites are evaluated and ranked according to a set of quality criteria, however the relationship between measured website quality and user satisfaction is weak [2]. Few e-government studies have taken a citizens’ perspective [3, 4] and real users are rarely involved in the development of eGovernment services [5].

A study of e-Government strategies in Sweden from the 60-ies until today concludes ”Moreover, the political focus is almost constantly on the producers of e-services, the public administration and the ICT-industry, not on the users/citizens” [6]. A citizen is mainly seen as an information supplier to the public agencies and not as someone to serve [7]. Citizen-centric eGovernment is not here yet, it is challenging
to develop services that meet real user needs and not only aim at reducing costs for the agencies [5].

The Norwegian tax agency was among the first national public agencies to provide a web page for public services [8], and has been a frontrunner among the public agencies in employing IT. Doing one’s taxes is highly automated in Norway, to a degree where many people do not have to do anything to hand in their tax return form. Many citizens do not practice doing their taxes even once a year, and their tax knowledge might degenerate1. Public paper forms may have a learning function which is lost when the paper form is substituted with an electronic schema where only the relevant posts are shown. By seeing all possible medical conditions where a driving licence will need to be reconsidered the citizen filling in the schema can recall this information for a later lookup [9].

The agency web page contains online self services for filling in the tax return, applying for or changing one’s tax card and notification of address (“flyttelmelding”). The tax agency wants to move more of the load of requests away from personal contacts at the counter or on the phone to the online self services. The telephone advisors at the TICC are expected to direct the callers to the online self services whenever possible.

This paper reports from a study of what citizens find difficult about tax, more precisely what the callers to the Tax Information Call Centre (TICC) ask about. Many topics and services requested on the phone will have a reply or a solution online, and the callers can also be understood as non-users of the tax agency’s web pages at least for the question or request of the call. Studying non-use can give us important knowledge about the technology in question, and can serve as an indicator to the citizen’s ease of use of the technology. It can also be used to improve the design of the services supporting automated tax [10-12]. Part of the the ambition is to find out why they call instead of using the agency web2. Do they need some explanation of the tax rules or regulations? Do they need a lookup of personal status information? Has some error occured? Are they perhaps lazy and want to avoid handling their tax themselves? Of course, some citizens do not use the Internet or have temporarily not access, and some services are not on the net.

The automated tax system with its rules, regulations, computers, forms and online services is a large infrastructure in constant change. The tax rules and regulations may change as a result of political processes, and new technology are taken into use for the communication with the citizens. Citizens having problems with tax call the TICC, and in this paper I will analyse their issues and problems with tax according to the three levels that Star and Ruhleder [1] use to analyse communication around infrastructure development.

The questions to the call centre are classified and analysed according to Star and Ruhleder’s three levels of communication [1] to get an understanding of the complexity of the issue. The analysis will give a basis for a discussion about how

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1 This applies to filling in and submitting the tax return form. Employees will still need to give their employers their tax card for advance tax.
2 The tax web site contains both information pages and transactional services, and includes also links to services run by other public agencies. I will use the notion “online services” to indiscriminately cover all these.
easily the issue can be solved by the citizen using the tax web pages or online self-services. The theory gives a framework for understanding and talking about increasing complexity and increasing challenges for online self-services in resolving the issues of the citizens.

This study indicates that even though many questions on the phone can be answered with information on the web pages, and many phone requests could have been handled by the citizen herself using an online self-service, the citizens need clarifications and explanations that goes beyond this. The question might be based on misunderstandings about tax or erroneous assumptions, but the advisor will usually be able to interpret the question and provide adequate help that hardly can be provided by a web page.

The rest of the paper is organised as follows. In the next section the framework used for analysing the requests will be presented. In section 3 I describe the empiric case and methods used. Section 4 presents the telephone calls and analyses the requests, which is discussed in section 5 together with a brief discussion of design implications. The last section concludes the paper.

2 The three levels of complexity

Star and Ruhleder [1] describe how users and potential future users experienced problems with acquiring, installing, getting access and using the Worm Community System (WCS), a custom-built pre-web client system for sharing and accessing research work on the gene sequence of the nematode *c. elegans*. Star and Ruhleder base their analysis of the issues and problems that the biologists experienced when they used or started to use the WCS on Bateson’s three levels of communicating [13]. They turned to Bateson “as a theorist of communication for a more formal understanding of the ways in which communicative processes are entangled in the development of infrastructure” [1, section 4]. Star and Ruhleder use the three levels (Bateson use the notion “orders”) to analyse communication and mutual learning between designers and users of the WCS. First I describe the three levels in Bateson’s version and then as they are adapted and described by Star and Ruhleder.

Bateson’s three levels of communication parallels first and higher order mathematical logics [13, cited in Star and Ruhleder 1996]. The three levels are:

A *first level* utterance is a straightforward statement about facts, i.e.: “The cat is on the mat”.

A *second level* utterance is about the first level statement, i.e.: “I was lying when I said that the cat is on the mat”.

A *third level* utterance is about the second level statement, i.e.: “There are many conflicting approaches to evaluating whether or not you were lying about the cat and the mat”.

The complexity of the utterances are increasing with higher order. While it is easy to check if a first order utterance is true, it is not so straightforward with a third level utterance.
Star and Ruhleder [1, section 4.1] adapts and applies these levels to the communication about issues and problems with using or starting to use the WCS. Their version of the three levels (or orders) are:

First level issues: These are described as being most obvious, as they tend to be about concrete issues and can be addressed by concrete solutions, for example about how to download the source code of WCS. This includes finding out about the WCS and learning how to acquire, install and use it together with other software. First order issues are not limited to start-up problems, but recur over time as well as resources and work patterns change.

Second level issues: These arise as issues about the first order issues, out of unforeseen and unknowable contextual effects, or a collision between or interaction of two first order issues. They broaden the context of choice and evaluation of the first order issues. For example will downloading the source code be a second order issue if you do not know the required software for downloading.

Third level issues: These are issues about the second order issues and how to choose among them, and are inherently political or involve permanent disputes. They have the widest context. They involve dilemmas not easily resolved by one individual, an example given is how the biologist researcher should share his time between doing worm genome research or fiddling with the WCS software.

In Star and Ruhleder’s (ibid) analysis the first order issues were those that were the most obvious to their informants, as they tend to be concrete issues that can be addressed by equally concrete solutions. First order issues centered around installation and use of the system, including finding out about it and acquiring the software, but recur also over time. Second order issues is seen as the result of unforeseen contextual effects or as a collision between two first order issues. They can be addressed by an increase in resources together with a heightened coordination or cooperation between user communities and support. They can also become third-order issues when in conflict with other second order issues. Third order issues have the widest context and may not be recognized as such as they often are taken for granted. They arise out of multiple meanings of information, network externalities and may have long term implications. They are also “inherently political or involve permanent disputes” [1, section 4.1] and cannot be resolved locally.

2.1 Trans-contextual difficulties and double-binds

Star and Ruhleder [1, section 4.3.1] give an example where the use of the WCS presuppose knowledge and use of the operating system Unix. Knowledge about Unix is a first order issue for the WCS developers but a second order issue for the biologists. This led to trans-contextual difficulties for the biologist users in understanding the communication with the technical developers.

Trans-contextual difficulties create a “double bind” when a message given on one level is negated on another. For instance was knowledge about Unix seen from the developers as a first level issue but spending time and effort on learning Unix was not easily available for many biologist researchers.

Using this analysis of the emergent WCS Star and Ruhleder (ibid) could predict the failure of the infrastructure. They identified several double binds that hindered the
biologist researchers from using the system even though it seemed to fill a need for electronic communication within the worm community. The biologists preferred to use simpler infrastructure technologies like gopher and ftp (this is 1995) instead of the custom-made WCS which was rich on tailor-made functionality for worm research.

I will apply this typology to the issues of doing tax seen through the questions to the TICC advisors from the citizens. The complexity of the issues will be analysed according to how they can be resolved. However, first I will describe the TICC and the research methods used.

3 Case and Method

Doing the citizens’ taxes is a shared responsibility of many actors: first and foremost the tax agency and the citizen, but also the employers and other public agencies may have a role in doing it. The tax agency collects data about a citizen’s income and fortune from employers and banks, and calculates the taxes. The citizen is required to check these data in the pre-completed tax return form, correct them or add more if necessary. From the citizen’s monthly wage payments the employer withholds tax according to information in the tax card. For some citizens the welfare agency acts in the role of an employer. Information about e.g. a citizen’s real estate is provided by the mapping authorities.

It is possible for a citizen to do one’s taxes for one whole year by default, as the process of collecting data and filling in the tax return is automated. However, it is possible to check, correct and fill in the tax return form both on paper and online on the agency’s web pages, as well as changing or ordering a tax card or an exemption card. The Tax agency web pages contains information about tax rules and regulations as well as some online services. Some services cannot be done on the net. For these needs, or if something unexpected happens, the economy changes or some error is suspected, many citizens will need to call the TICC.

The TICC was established in 2008 after the latest major reorganization of the Tax agency. Previously each tax office answered the phone, now the TICC answers all questions nationwide. They are organized in eight offices and all offices can answer all phones. The phone advisors answers the phone on different lines according to tax topics such as “employees and pensioners”, “business”, “tax card” or “inheritance”. These topics are presented as choices on the spoken menu that greets the caller when calling the tax agency.

The TICC received 2,7 million telephone calls in 2011, where 1.4 million calls were about personal tax. The average call lasted 3:49 minutes, but they may take much longer. The TICC is expected by the agency management to reduce the number of telephone calls by directing the callers to the online self services.

The field work took place from April 2010 to March 2012 in one office of the TICC. The main activity was co-listening to the telephone calls to the TICC. Observations, interviews and document analysis has been supporting activities to understand the questions they receive, the TICC and its organisational context.
The call advisor sits in a light, open office landscape (see figure 1). Each has an office desk with a PC, a phone and sometimes a pile of papers (see figure 2). They use a headset with a microphone, and can look up tax-related personal information of the caller in the many databases of the tax agency. They know most tax rules and regulations by heart, and rarely look up tax rules. They may need to look up dates for deadlines, or addresses or phones numbers of tax offices and case handlers if a caller asks. When needed some use a small, handheld calculator while talking on the phone (see figure 3).

I have co-listened to 474 telephone calls to the TICC, and spent around 75 hours in their office co-listening and observing. I have listened mostly to calls on the “Employees and pensioners” line, but also on the lines for “Businesses” and “Population Register” for broadening the understanding about the tasks and topics of the TICC.

When co-listening I sit together with the advisor at his or her desk. I have a headset with a microphone as well and can hear the conversation and look at what the advisor is doing on the PC and the desk. Sometimes there is time to talk a little between the calls, and I can ask questions about the call. If the traffic load on the phone is high, I try to interfere as little as possible. When co-listening I take notes with pen and paper, these were transcribed and filled out from memory as soon as possible afterwards.

I have done eight interviews with tax advisors and a manager, and six interviews with people working with IT and web within the agency. In addition I have interviewed one expert from an NGO. The interviews have been transcribed and analysed, and together they give a picture of how the agency work with targeting their electronic information towards the citizens and how the citizens experience tax and the online services. Interviewing the advisors away from the PC has also given important background for me to recognize topics and understand what the advisor is saying and doing during the phone calls, as this is a real-time situation with few occasions for asking on-the-fly.

Observations: While on the premises of the TICC I make observations of the activities there, and talk with people at the coffee machine if possible. I pay attention to information on the whiteboard and the electronic screen with traffic information located at a central spot in the locale.
**Document analysis:** TICC annual reports gives statistics about the phone calls and which lines get the most traffic. Various steering documents give an understanding of how the agency sees its objectives.

**Ethical considerations:** Due to privacy reasons I made notes with pen and paper during the phone calls, and did not record the conversation. I was not interested in personal data. Co-listening is routinely taking place at the tax agency for many purposes such as quality improvement and training. Everybody doing co-listening, including the researcher, has signed the standard non-disclosure agreement of the tax agency.

Making notes with pen and paper provided me with very few verbatim quotes, and I sometimes had to do on-the-fly simplifications of the requests in cases where the caller made a lengthy explanation that my note taking could not follow. I often had to simplify details of tax rules. Both for such practical reasons and privacy reasons the examples below are often simplified.

**Method for analysis:** The empirical data are marked up according to the three orders of the analytical framework presented in the previous section. The data will be the telephone calls, interviews, what the advisors and other informants explain as difficult questions, and what can be found from reports and other material made by the tax agency about problems that the citizens experience with tax. This is based on what is reported as difficult, but also what is interpreted as difficult from the advisor (and me) based on the question from the caller.

The analysis process has been iterative where early results have influenced the later data gathering. The transcripts were read and reread and each call was considered for level 1, 2 or 3. Both the notes and the transcripts became more targeted at the end of the field work because I developed a better understanding of the advisors’ work practices. Because of this iterative analysis process the later periods of field work provided more relevant data and many of the examples below are from late in the field work.

4 The questions and their issues

It is a widely held belief within the tax agency that many citizens call unnecessarily—they could have used the online self services instead. Because the tax agency wants to reduce the traffic load (and the staff) on the phone all advisors are expected to direct the callers to the web pages for self service if the request can be solved that way. One advisor describes her work to be to “guide the caller in navigating their online systems”. The rationale is that the callers will learn that the web pages can be used and how to use them the next time. However, my results indicate that it is more complicated than that.

First, some advisors explain that they cannot always follow this policy so they give direct help instead, for example in cases of “old people who struggle” with the online services the advisor will change the tax card on the phone instead. The advisors negotiate the policy according to the needs of the caller and the caller’s perceived ability to handle her case herself.
Second, my analysis of the calls indicate that the communication around the issues of the questions is more complicated. In the following my analysis of the calls are presented according to my classification of where they belong in the levels one to three. Within each level I give some examples of typical calls and describe why they are placed in that order. I have chosen examples that I hope illustrate the rich variety of questions and show the different levels of complexity in how they can be resolved.

**First level issues: I need a new tax card**

The typical first order question is a straightforward request for information or a service. First order issues may include questions about tax regulations and how they should be applied in the personal case, or a request for the execution of a service. The advisor handles the first order issues by providing factual information, usually from the heart, about deadlines, addresses, income limits, what goes where in the tax return form or the online form for a change in the tax card. Often they look up the agency databases and gives more personally tailored, detailed advice on how to fill in the form. With this additional information and advice the caller has received a satisfactory reply, or is able to handle the rest online herself, for example as in the following simple request for factual information:

C: “Can you please tell me the opening hours of the tax office in city X?”
A: <searches the external web pages for information about this tax office> “It is open from 9 to 15”.

The simplest reply from the advisor is to explain about the rules and regulations with neither a lookup in the agency databases nor in the tax rules. For example:

C: “I need a new tax card”
A: You can order one yourself on the net if you have your PIN codes to log in.
C: “Yes, I have them”
A: < describes where the caller can find the online form>

Learning that it is possible to apply for a tax card online can be a first order issue. Many requests will require some explanation and guidance from the advisor for the citizen to be able to handle this herself. In this example the caller has received a table-based tax card:

C: “I have received a table-based card but usually I get a percentage card.”
A: <explains how to understand and use the tax table >
C: “If I do not want a table card can I change it myself on the net?”
A: “Yes” <explains how to force the system to issue a percentage-based card > (call 20120111-14)
Information on how to force the system to issue a percentage card when the default is a table card is not given online. The web page contains legal text about the two kinds of tax cards, but not the practical advice on which box to tick in the online form to force a percentage card.

Some of the first order issues are first order for the advisor only. The request is second order for the callers because they do not have enough tax and system knowledge to be able to formulate their request and find the factual information themselves or use the online services.

Second level issues: I suspect something is wrong with my tax card

The simple first order requests are not so frequent. Most often the caller has some additional questions about how the rules will be applied in the personal case, which leads the advisor to look up the agency database in question and see what is listed there for this citizen. Many calls are requests for a tax card that is not received in the mail. This might reveal errors or unforeseen contextual effects, for instance in the address information, that might explain why the citizen has not received the tax card.

The second order issues require some contextual knowledge or information to be answered or resolved sufficiently. The typical case is when the solution to a request from a caller is dependent on some other issue that is unknown to the caller, or could introduce another problem. In the following example some internal system quirk could not be known by the caller:

C: “Is it tax on the minimum state pension?”
A: “No, it should not be. What is your national identity number?”

C: “I don’t know, but my name is X and my birth date is Y”
A: <looks up the name and birth date in the Population register, finds the citizen’s national identity number there, and use this for a lookup in the tax card database> “I see you have a tax card with 2% tax. As a minimum state pensioner you should have no tax.” <he proceeds with explaining how only 85% of the standard allowance is used in the automated tax card calculations, and this will explain why the caller has received a tax card with 2% tax. He fixes the tax card so that no tax is issued> (call 20120111-18)

The caller had no way of knowing that the advance tax system was calculating advance tax with an error margin. This issue has little to do with tax understanding but more to do with learning system peculiarities.

Many callers ask for a copy of the tax certificate. The term “tax certificate” is not relevant for private citizens. Depending on the intended use, the caller might mean a copy of the tax assessment or the tax return form. The advisor usually takes time to ask for the intended use, as in the following example:

C: “Hi, I wonder if you could send me a copy of my tax certificate?”
A: “What are you going to use it for?”
A: “The bank”

A: “They want to have a copy of your tax return form.”

C: “Yes, ok, please send that.” (call 20120111-21)

Reprint of these documents are not available as an electronic self-service on the agency web pages, only if the citizen handed in the tax return electronically she can print out a copy herself.

The second order issues require some contextual knowledge that might be either personal or not publicly known, or both. In our next example a young citizen will need knowledge about tax rules and regulations so that she can argue with her employer, who has withheld too much tax from her salary. This can seem like a level 1 issue for the tax advisor, for whom the regulations in this area is factual knowledge, but for the caller it will be a second order issue because the context makes itself visible and will need to be addressed. She will need to use knowledge about tax to convince her employer to correct their tax withholding:

A man calls in the middle of January:

C: “Hi, I am calling for a young lady. I live together with her mother. It is about the employer of the young lady. They have withheld too much tax [from her salary this month], 50%, because they say that she has not handed them her tax card for the new year.”.

A: “They will need to correct and settle that for the next tax withholding. The tax card for the previous year can be used in January next year.” (call 20120118-16)

The employer has done an error that results in too little money this month for the young lady. The tax advisor cannot help her directly with arguing with her employer, but can provide her stepfather with information so that she is better off to handle it herself, possibly with his aid.

As the context for a solution to the issue of the call widens, the caller is less able to understand and handle the issue herself, as in the next example:

C: “Hi, my tax card has not arrived in the mail, neither for my spouse. The place where I live has changed its address, could this have something to do with it?”

A: “Yes, I think this has something to do with it” <looks up the caller in the tax card database, makes a temporary address change to the new address and prints out a copy of the two tax cards > “I will send you a copy of the two tax cards”.

C: “Thank you!”

3 If the young lady does not succeed in convincing the employer to correct and settle her salary payments, she will receive a return of the excess tax money in June next year, at the earliest, with a little interest rate.
A: <She then checks the caller’s address in the Population Register>
“I can see that you are listed in the Population Register with the old address as your postal address. I make a note about this and give to those who maintain the Population Register”

C: “Thank you!”

A: <finds out after the call that the tax agency has received the tax card in return in the mail> (call 20120118-20)

The municipality has made the decision to change the postal address of where the caller lives, and the public registers are not updated correctly. Knowing that it is possible to apply for a tax card online will not help in a situation where you do not live on your registered address, which is the one used for sending the tax card in the mail.

Third level issues: The welfare agency directs me to you

The third order issues have the widest context, where it is not clear for the caller who is responsible and how the issue can be resolved. Often the issue cannot be solved by one person or agency alone, but may need a back and forth between public or private entities. The next example is about a citizen who has issues with both the welfare agency and the tax, and cannot call or speak for himself:

C: “Hi, I am a social worker calling from municipality X. I sit here with a guy who receives unemployment benefits from the Welfare Agency. 50% tax is withheld from his support, and this leaves him with too little money left.”

A: “What is his name and national identification number?”

C: <provides this, and also explains what he receives in social support>

A: <looks up his tax card, and enters the figures given over the phone by the municipal social worker directly into the database. She knows by heart the standard amount of the social security, even when the client cannot tell what he receives> “This happens when NAV realizes that he has not submitted a new tax card for this year. I will send a new tax card to the client c/o you, and the Welfare Agency will also receive one electronically tomorrow”. (Call 20100428-4)

In this example three public agencies were involved. The Welfare Agency paid the client his unemployment benefits and withheld suddenly 50% tax when they discovered that the client had not handed them a valid tax card for the new year. The social worker of the municipality had to take care of the citizen when he was not able to take care of himself. They would probably give him some social support money so that he had enough to live for this month. Disentangling this issue between the different public agencies and understanding that the root of the problem was the
welfare agency’s response to the missing tax card, requires contextual and system-oriented knowledge.

The following call is from a young man who came in a difficult situation when his employer went bankrupt. He received state guaranteed salary for some time. At the time he was not taking care of the documentation for his salary, and this led him into unforeseen problems later, when the tax agency did not accept his reporting of the income.

C: “Hi, I have received a bill from the tax collector of 13,000 kroner of excess tax. This claim is because I did not report one of my incomes two years ago”. <he explains at length how one of his employers at that time went bankrupt and that he received some guarantee income from the state. He claims that this income is reported twice so that a double tax claim is calculated>

A: <looks him up in the databases of tax returns and letters from the tax agency. He can see that they do not accept his figures and that they will change the taxation of his income for that year. He can also see that the young man received income from more than one employer and also that he received unemployment benefits that year. > “I can see that you have received a claim for 10,000 kroner for penalty tax. Did you not report the income from the employer that went bankrupt?”

C: “I really understand very little of this”

A: “Are your salary payments registered in the double?”

C: “I cannot remember that this long time afterwards”

A: “Now you have to think: Did I receive a salary from [the bankrupt employer] as I should? Did I receive unemployment benefits afterwards?”

C: “I cannot remember this, but things went ok at the time this happened”

A: “You will have to go back to your online bank and see what you received from your employer before they went bankrupt. If you disagree with their reporting, you must complain formally to the tax agency”.

C: “Ok. I will call again if I need so.”

A: “No, you ought to complain, preferably with a documentation of the salary you received”.

C: “Thank you! I have got some new ideas as to how I can handle this.” (This call is simplified and shortened as it took 29 minutes) (call 20120111-5)

After the call I asked the advisor what he thought had happened, and he replied that he believed the young man had mixed up his payments. However he cannot know for sure. The advisor could not find out which version of what had happened were correct. It depended on the young man’s ability to provide documentation for his claims that his income in the chaos of the bankruptcy was doubly reported. The tax
agency did not have this documentation and the employer did not exist anymore. Being aware that your employer may make errors in their reporting to the tax agency and that the sole person to correct it is yourself will be a third level issue, in that you will need to understand that there might be more versions of the story and you will have to provide documentation that supports your version.

In our next example the father asks a tax question for his daughter. The first half of the call he was asking for his wife:

C: <asks a question for his wife, afterwards he says:> “While I have you here I have a question for my daughter as well. She has had 36% tax withheld.”
A: “Are you sure she does not have a table-based tax card? May I have her national identification number.”
C: <provides number>
A: <looks up the daughter in the tax card database and can confirm that she has a table-based card. She explains what this means> “A table-based card is ok for her, and she can change it if she starts working. Does she receive work assessment allowance?”
C: “Yes, and it seems that NAV [the welfare agency] withholds 36% of her benefits.”
A: “You will need to find out what the welfare agency really does, and tell them that they must withhold tax according to the table” <takes a small handheld calculator and calculates the percentage that the welfare agency has withheld from figures given by the caller. She can confirm that the welfare agency has withheld too much>. “You must contact NAV and tell them to withhold your daughter according to the tax card table”. After the call she says to me “NAV, NAV oh we struggle a bit with them”. She says a lot of mistakes and misunderstandings happen for tax payers receiving benefits from NAV. “And if they call NAV and ask them to withhold according to the table they refer the client to contact us, as if it is something wrong with the tax card. This happens even though NAV receives the tax cards electronically from us” (call 20120118-4).

In this situation the tax advisor could only help the caller with clarifying the rules in relation to the daughter, and advice him to contact the welfare agency and tell them how to withhold tax from her benefit. The issue has a wide context, the citizen will need to understand tax and disentangle a deadlock between the two agencies. If the citizen does not manage to follow up and do this, the issue of the telephone call will not be resolved.
4.1 Trans-contextual difficulties, double binds and online self-services

The tax agency’s own report about who call the TICC found that it is the relatively young citizens who call the TICC, those who otherwise are eager users of internet and digital services. One advisor said that “the winners are those who have used the previous paper based tax return form”. These citizens have some previously acquired knowledge about tax that is less available today.

There are many reasons why a citizen do not use the online self-service for doing taxes even though one is available: the citizen needs a database lookup of personal status related information or some explanations and advice, or both. Often Internet is temporarily unavailable and the caller is in a hurry. Often the citizen is able to log in and change personal data in the online tax card form, but first he or she needs some individualized advice about how tax rules and regulations will be interpreted in the personal case.

Widely held beliefs in the TICC as well as the statistics in the TICC’s annual reports give the impression that many citizens call unnecessarily. However, there are plenty of trans-contextual clashes among the issues of the telephone calls. The questions are first order issues for the advisor but the lack of tax knowledge will make the issues second or third order for the citizen. The same goes for the system or technical knowledge necessary for example to log in with the use of PIN-codes.

A double bind occurs when a level one message is negated on a higher level. In our examples above a double-bind happened for the caller who had got her postal address changed. She could use the online system for ordering a copy of the tax card but would not receive her card in the mail because of the erroneous address. The advisor resolved the double bind and issued the tax card directly. The callers who experienced that NAV did not accept their tax cards and told them to contact the Tax agency were also in a double-bind between the two agencies, until the advisor resolved the issues.

5 Increasing complexity challenges autonomy

The three levels of communication [1] provides a framework for discussing how the complexity of the tax issues increases with a wider context. The tax advisors will at their best help the callers reduce their tax issues from higher to lower levels. Seen from the advisor many issues are first level, but the analysis presented above indicates that for the citizen many are of second or third level. When the advisor provides explanations the caller is more competent and the issue can be reduced to first or second level, where they are more easily resolved.

The caller does not always understand what makes an issue problematic, and the advisor helps by disentangling the situation into steps the caller can handle herself. The need for the advisors to disentangle the issue has more to do with a complicated life situation or context of the caller than how complicated the involved tax rules and regulations are [14]. First level issues can often be solved by providing factual information, second level issues will often be about a problem that require a database lookup of personal information and third level issues cannot be solved during the
phone call but will require that the caller interacts with some other agency or private enterprise.

Most issues are almost by definition first level for the advisor but second or third level for the caller. The trans-contextual difficulties may explain why the tax agency thinks the citizens calls unnecessarily.

The tax agency has found that it is the relatively young citizens who call the TICC, those who otherwise are eager users of internet and digital services, and that the winners are those who has used the previous paper based tax return form. This finding contradicts Jaeger [15] who found that in a US context the eGovernment users are younger, whiter, better educated and wealthier than the average citizen [15]. I take this to indicate that previous knowledge about taxes for experienced grownups is more important to be able to use online tax services than merely Internet competence, or put another way: that tax literacy is more important than net literacy when it comes to being able to do one’s taxes online.

A person in a double bind is stuck until the double-bind is resolved, either by the person herself or with the help of others. Resolving a double-bind requires both to recognize it as such, and sufficient overview to see where to start disentangling it. In some cases the advisor helps directly for instance by issuing a new tax card, but in other cases the advisor can only explain the rules and tell the caller to talk to her employer. This overview implies understanding the context, and is only partially about tax rules and regulations. To understand the context of a tax issue with for instance private and public agencies involved, is a question of understanding the tax system. Filling in public forms can provide a basis for learning [9], and the automated tax gives few opportunities for learning purposes. Because of the automation many citizens do not practice doing their taxes even once a year, and their tax knowledge might degenerate.

Star and Ruhleder (ibid) predicted the failure of the infrastructure because of trans-contextual difficulties and double-binds for the (potential) users. When we talk about an eGovernment system, failure must be understood differently. The services will not be a failure as in a commercial market because there is no market. These services are almost mandatory to use when interacting with the Government. Non-use can be an indication of failure, at least if the proportion of non-users is high. And even for the citizens-as-users the online services may be cumbersome or problematic to use without this becoming known as a failure.

Thomas and Streib [16] argue that for citizens less able to use eGovernment services “other channels to government must not be closed off or contracted”. If the phone service is shut down or becoming a bottle-neck some citizens will have their autonomy challenged as they risk to not receive adequate help when they need it. What I think is the most problematic issue here is if the agency makes many citizens less adept in handling their own taxes because they will have to use an online eGovernment service that are not giving relevant and adequate support for all kinds of issues.
5.1 Design Implications

I will close this discussion with some comments on how the results of my analysis can have implications for a redesign of the communication with the citizens, more closely which implications this will have for the electronic communication via websites and services.

On the phone level one issues are solved by the advisor when he or she provides factual information, or directs the caller to a website or a self-service. Level two issues often requires the advisor to look up personal information and explain the rules, and perhaps correct the database. Level two issues are not always solved during the phone call but the caller will hopefully be able to solve them herself. Level three issues cannot be solved completely during the phone call as some interaction between agencies is required for a solution. With the explanations from the advisor the caller will hopefully be able to take steps to solve it herself.

Factual information given over the phone can easily be given on a website instead. Today the agency website contains lot of factual information. Some level two issues can be addressed with giving more practical and detailed information on the website, together with giving the citizens access to lookups in the agency databases so that they can check up on information about themselves. However, unforeseen contextual effects occur on the second level or higher. Second and third level issues make more challenging demands for online solutions. Disentangling a level three issue will require access to individual information, specific and detailed explanations and practical advise on how to proceed when other agencies or private businesses are involved.

There are two kinds of design implications that can be drawn from this. One is that how the tax agency understands the requests to the TICC will have implications for how they organize their support and how they design their online services. Seeing all issues as first order may make it look like tax questions can be sufficiently answered by factual information on web pages or online services. Seeing the issues as higher order or acknowledging the occurrence of double-binds for the citizens might provide incitement for the agency to both recognize the need for a good phone service as well as develop individualized online services with more explanations.

The other kind of implication for design is about who is involved in the design of the online services. How can we design for active and learning citizens? Ilshammar, Bjurström [6] argues that there is a gap between political IT discourses that governs the work of the public agencies and the general ICT discourse, and suggests that e-Government research could help bridge this gap. A focus on the user is central in many IS research disciplines. I will suggest that research giving the citizens a voice will help bridging the gap as well, both in e-Government research and in public ICT policies.

Many of the callers would not be available for participatory design projects [17] or usability testing [18]. The citizens calling the TICC vary a lot in their background and life situation, and in this study they are all given a voice, albeit indirectly.
6 Conclusions

Empirical data from the Tax information Call Centre (TICC) is used to discuss why citizens call about tax issues and to get an understanding of what makes tax complicated. The callers as non-users of the online services tell us among other things about electronic services possibly not working, data bases not being updated or system quirks that are not publicly known. These empirical data from citizens’ telephone calls to the TICC is analyzed in the framework of the three orders of communication [1] and gives a basis for discussing how the complexity of the issues increases with a widened context of the issue. The advisor solve first level issues by giving factual information over the phone or directing the caller to a webpage or an online service. Solving second level issues will require a lookup of personal information and more specific and detailed tax and system knowledge, and perhaps some database information need to be corrected.

Third order issues involves disentangling between several public and private agencies, and cannot be solved by one person alone. Trans-contextual difficulties occur because the issue is often first level for the advisor and second or third level for the citizen. Double binds can occur if e.g. the citizen have to use an online self service but cannot log in. Third level issues and double binds provide challenges for a redesign of the electronic means of communication with the citizens.

Acknowledges

A heartfelt thank you goes to the TICC who let me hang around and co-listen. Many thanks go to my supervisor Tone Bratteteig who suggested that I should analyse the empiric material according to the three levels of communication!

References


Usability Work in Limbo: Barriers to Usability Work in Practice

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Abstract. There is a lack of consensus over why the observed increase in usability awareness in organizations has not been matched with an increase in its practice. This paper seeing this occurrence as pertinent to the resolution of the agile usability problem focuses on examining it within a systems development organization. An interpretive case study using the Toulmin model for analysis is presented. This case reveals two operational barriers existing as ingrained practices within the organization. These are the low importance placed on the usability designer role and high importance placed on functionality. We find that though the grounds and warrants which reinforce these barriers are weak, they highlight a need for a revisiting of the arguments that have been made against them in the literature. The findings reveal valid concerns that might prevent the practicability and applicability of recommendations from the usability literature.

Keywords: Usability work, Agile development projects, Information Systems, Toulmin analysis.

1 Introduction

In response to the challenges posed by agile methods to the systematic execution of usability work in agile projects, descriptions of how usability work should be performed in such projects have been provided in the Information Systems Development (ISD) literature [1]. Conversely, the evidence that underpins these recommendations has been observed to be anecdotal and contradictory, thus there have been calls for more focus on how usability work and agile methods are being integrated in practice [1-3]. From the few studies that have adopted this approach, insight has emerged into the key role played by contextual considerations in effecting the integration of usability work and agile methods; and strategies by which such considerations might be managed [2, 4]. However, what is not certain is whether these findings are actually relevant in practice, as these studies have mostly focused on projects where usability work is both appreciated and structures have been put in place to enable its execution.

The premise for this paper is the observation that although there has been an increase in the awareness of usability in organizations, this has not necessarily translated into an increase in the number of organizations who actively engage in usability work [5-7]. This representation of practice justifies the need for, as a starting
point in empirical agile usability research, an examination of the reasons for this gap. More so as the reason for its existence is not fully known [6].

These are the issues we examine in this paper. Specifically we ask, “What are the barriers to the enactment of usability work in organizations who demonstrate an appreciable awareness of usability work?” Our focus here is on the explanations for this phenomenon, viewed from the perspective of a case organization applying an agile development method. The rest of the paper is organized as follows. In section 2 we begin by providing a review of the relevant literature. We proceed in section 3 by introducing our analytic tool which is the Toulmin model, before presenting the case study.

2 A review of the agile usability literature

The emergence of agile methods signaled a new era in software development. Unlike the rigid, engineering approaches which typified the early years of software development, these methods were flexible, lightweight [8], and more amenable to changes in business requirements [9]. In time as their use within ISD became mainstream, usability researchers began to examine the extent to which these methods took into account usability considerations. The constraints they identified in relation to this include how agile methods restrict the amount of time set aside upfront for the planning and developing of user interfaces [10], and the vagueness of the customer role during development [11]. Attempts have been made to reconcile these identified incongruities between agile and usability work by integrating them [12, 13]. These exist in the form of process descriptions detailing how usability work should be performed in agile projects [1] . An overview of these recommendations and their corresponding justifications is provided in table 1.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upfront design</td>
<td>Insight into use context and user perspective</td>
</tr>
<tr>
<td>Low-fi prototypes</td>
<td>Increases understanding of the user interface and usage</td>
</tr>
<tr>
<td>Testing in between iterations with users</td>
<td>Reduces rework and increases user buy in</td>
</tr>
<tr>
<td>Designers and developers work in parallel</td>
<td>To provide sufficient time for designers to design</td>
</tr>
<tr>
<td>Usability designers should be present in project</td>
<td>To ensure usability is always at the fore</td>
</tr>
<tr>
<td>Usability designers should be a part of the development team</td>
<td>To facilitate easier sharing of findings from user research</td>
</tr>
<tr>
<td>End users should be involved</td>
<td>To ensure user needs are adequately taken into account</td>
</tr>
</tbody>
</table>

Table 1. Usability work process descriptions [1]
The anecdotal evidence underpinning these recommendations has motivated calls for an empirical approach in the study of usability work and agile methods [4, 14]. The general consensus which has emerged from such examinations of practice is the role played by contextual considerations in effecting the integration of usability work and agile methods (ibid). Additionally strategies, comprising aspects such as work arrangements have also emerged which shed light on how usability and agile practitioners integrate their work activities in practice (ibid).

Our study is similarly structured along these lines as we also focus on practice. However our point of departure is that we examine an agile systems development setting where usability work is not being actively engaged in, despite a high awareness of its benefits. This paradoxical situation which dispels the popular notion that there exists a direct relationship between organizational awareness of usability work and their decision to engage in it [15, 16] is one whose basis for its occurrence is not known [6]. Further it has been identified as not being an outcome of the development method used (ibid).

We contend that it is necessary to examine this paradoxical situation as it has been affirmed to typify most ISD organizations [5-7]. This observation raises questions on the relevance and transferability of findings from empirical agile usability research, more so as such research has mostly focused on contexts where this paradox is absent. To ascertain this would first require an investigation of the paradoxical situation. Indeed to understand is a necessary first step. This is the motivation for our research.

This case study was initially supposed to be a pilot study to validate from practice the usability work descriptions in table 1. However based on our initial meeting with the product manager of our case organization, we realized that while in this organization there seemed to be a high awareness of usability work; they did not have a structured approach to usability work in place. Further this was not perceived to be an impediment. We therefore allowed the data to speak for itself, and found barriers to usability work in practice. The next section describes our research method.

3 Research Setting and Method

We give an overview of our research method and the case organization, before elaborating on our data collection and analysis.

3.1 Research Method

The research method we employ is the case study approach. A method known for its enabling the in-depth examination of phenomena within its natural context [17] and for its ability to be used within all three IS research paradigms [18-20], namely the positivist [18], interpretivist [19] and critical realist paradigms [20]. Further we approach this case with a mindset informed by the interpretive paradigm [19] acknowledging that human behaviors can best be understood by examining their own sense making and motivations in context. To focus our data analysis we need to
analyze the reasoning and argumentation. To do this we chose to employ the Toulmin model, introduced in the following.

### 3.2 Toulmin Analysis

The Toulmin model is useful in analyzing reasoning and argumentation [21]. This is as it comprises constructs which aid in the assessment of the credibility, plausibility and possibility of assertions by individuals [22]. Arguments as depicted by the model refer not to human dispute, rather it is the train of reasoning that individuals employ to provide support for their ideas and actions when challenged or criticized [21]. Figure 1 is a diagrammatic representation of the model and how its constructs interact.

![Fig. 1. A Toulmin Model.](image)

In its operationalized form, it consists of the following steps [22].

- **First pass**: Read through the whole document, identifying topics, arguments and the most obvious key claims. Here a claim (C) is the assertion being put forward for acceptance [21].
- **Second pass**: Mark all claims, and identify grounds for (G) each claim. Here grounds are the specific facts relied on to support a given claim (ibid).
- **Third pass**: Within each argument, identify sub claims, elaborations and reiterations. Elaborations provide more information about claims identified and may be seen to consist of both rebuttals and qualifiers. A rebuttal (R) is a counter claim to the posited claim while a qualifier (Q) describes the conditions under which the posited claim would hold (ibid).
- **Fourth pass**: Provide implicit warrants wherever they are not obvious. Warrants (W) are the statements indicating how the grounds are connected to the claim as a means of determining whether they provide genuine support for the claim (ibid). When the connection is not obvious, such warrants are implicit and may need to be inferred [22]. In some cases such warrants may be explicit and exist in the form of well-known principles that are being appealed to by the speaker [21]. The backing (B) is the underlying basis on which the reliability of the warrant depends (ibid).

Within this study we employ the Toulmin model to analyze assertions on why usability work is not being practiced, despite an awareness of its importance.
3.3 Description of Case Site

The case organization is located in southern Norway and satisfies certain criteria applicable to any organization that should have the resources to perform usability work [23]. These include that the organization,

- Develops software with a graphical user interface
- Develops software for customers or for internal use
- Employs more than a single person.

The organization is presently staffed by twenty nine individuals. The product suite consists of projects, time, travel and expense processing applications that are used by companies. The organization has been using a modified version of Scrum for the last five years. Modified Scrum means that they do not estimate hours for task completion and plan based on this, rather they allow a greater degree of flexibility on the time taken for tasks completion as long as the project does not exceed its projected finished date. They also do a lot of long term planning and commit to clients what is coming out in the next product version. Thus there is none of the uncertainty that characterizes the typical application of Scrum. They however have daily Scrum meetings as prescribed by the Scrum method. In the next section we present the findings from our data analysis.

3.4 Data Collection and Analysis

Six participants selected by the project manager agreed to participate in this study. In order to avoid elite bias [24] these were selected based on their involvement in product development, rather than their position in the organization. A profile of each of these participants is outlined in table 2.

Prior to the interviews, a covering letter which described our research project and contained assurances of confidentiality was sent to each participant. We adopted a semi-structured approach in our interviews. Each of these interviews lasted an hour and was conducted in an informal setting. Participants’ responses in each phase of the interviews were voice recorded and transcribed.

Table 2. Profile of participants.

<table>
<thead>
<tr>
<th>Role</th>
<th>Years in organization</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product manager (Scrum master)</td>
<td>12</td>
<td>PM</td>
</tr>
<tr>
<td>Functional architect/developer</td>
<td>7</td>
<td>FA</td>
</tr>
<tr>
<td>Functional tester</td>
<td>2.5</td>
<td>FT</td>
</tr>
<tr>
<td>Customer center consultant</td>
<td>18</td>
<td>C</td>
</tr>
<tr>
<td>Developer</td>
<td>5.5</td>
<td>D</td>
</tr>
<tr>
<td>System Architect</td>
<td>5</td>
<td>SA</td>
</tr>
</tbody>
</table>

The data was iteratively analyzed using the Toulmin model. The focus was on two analytical categories. The first was the activities participants perceived to be ideal forms of usability work; the second was participants’ description of the organization’s
approach to usability work. By contrasting the two, we aimed to accentuate the
dichotomy between participants’ awareness of usability work and the present
approach to usability work in the organization. To ensure the transparency of this
analysis, based on Bygstad and Munkvold [25], we sent out our final analysis to each
of our participants to ensure we had not misrepresented or misinterpreted their
responses. Changes were made based on their feedback. However the mapping of our
data using the Toulmin model led to a large and complex model that cannot be
presented in this research paper due to space limitations. We have therefore
summarized the maps in tables 4 and 5.

4 Analysis

We start by highlighting some of the statements made by the participants to
demonstrate the organization’s awareness of usability. Then follows the main part of
this section, where we focus on the major themes that emerged in relation to their
practice.

4.1 Awareness of usability

Usability awareness was demonstrated in participants’ ability to provide articulate
descriptions of usability. Themes that emerged were considerations of the system
interface and aspects such as the system learnability and user experience. They were
also able to make a clear distinction between functionality and usability as is evident
from the quote below:

“So it (a reference to the software) is not only about the functional part. One thing is
that it has to be functional but it also should be a good experience to use it and that is
the layer that I would put into usability”.PM

The awareness of usability work was also apparent in the activities, which the
participants identified as being ideal usability work activities. These have been
presented along with the benefits participants associated with them in table 3.

Table 3. Ideal usability work activities.

<table>
<thead>
<tr>
<th>Activity (What to do)</th>
<th>Grounds (Why to do)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test for usability with users</td>
<td>For better feedback, to reduce rework</td>
</tr>
<tr>
<td>Have a usability designer</td>
<td>For user perspective, to ensure a unified and more appropriate approach</td>
</tr>
<tr>
<td>Upfront knowledge of users</td>
<td>To reduce rework, ensure user-system fit in terms of usability</td>
</tr>
<tr>
<td>Designer involvement from</td>
<td>To reduce rework</td>
</tr>
</tbody>
</table>
The understanding of usability work was not limited to participants’ ability to provide articulate definitions or descriptions. In terms of skill, we discovered that the FT had previously been employed as a usability designer in another organization; though this was not the role this individual was hired to play in this organization. Additionally the PM had also taken some courses in usability while at university and was generally familiar with usability design principles. However as evidence of a usability work paradoxical situation, participants when asked how usability work was performed in the organization generally asserted that it was not taken too seriously in the organization.

“So I would say that we consider it but we don’t do it, we don’t have like this is the usability way.” PM

“...then we hired a graphical designer, we didn’t do too much testing but some testing just to verify with our biggest customers that the new icons and colors were okay”. FA

From the answers provided to explain this paradoxical situation, two practices emerged as the most significant findings from the data. These are the approach to the usability designer role and the focus on system functionality rather than usability. Each of these is presented in turn in terms of the Toulmin model, in the proceeding sections.

### 4.2 Usability designer not part of the development team

The organization’s claim (C) is that to have a usability designer as a part of the development team is not justified. This claim and its associated constructs are captured in table 4. Five grounds for the non-inclusion of the usability designer as a part of the development team were identified by participants. These are (1) objectivity concerns, (2) the organization size, (3) the organization’s product development pattern, (4) cost of having a designer; and (5) the ad-hoc usability work efforts present occurring in the organization. The warrant (W) which provides additional reinforcement to 3 of these claims (3, 4, and 5) and its grounds is participants’ assertion that customer opinions on the organization’s products are favorable. It is interesting to note from the rebuttals (R) that there is no backing for this warrant (W) and the participants are well aware of this. This as they state that the feedback has been obtained from experienced users and that they have not really had an in-depth customer investigation which focused on usability. As stated by FA:

“We questionnaire them (users) once a year, but then it is for like the company as a whole, the software and everything”.

Additionally there is their acknowledging the limitations of having a developer stand in for a designer which rebuts their justification of this practice.
An addendum to this claim is the sub-claim where participants stated that it might at times be justifiable to include a usability designer in projects. Two grounds were identified for this sub-claim. The first is that this should occur when the product being developed is new and there is less concern on users’ familiarity of the system. Secondly that utilizing a designer in this manner would ensure the objectivity of the designer is maintained.

### Table 4. Usability designer claims.

<table>
<thead>
<tr>
<th>Claim (C)</th>
<th>Grounds (G)</th>
<th>Warrant (W)</th>
<th>Rebuttal (R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usability designer not necessary in the development team</td>
<td>Objectivity concerns (Designer is more prone to decision bias)</td>
<td>Not provided</td>
<td>Not provided</td>
</tr>
<tr>
<td></td>
<td>Size (“We are too small to have the role”)</td>
<td>If what we are doing was bad our customers would be complaining</td>
<td>Quality of feedback (“intangible” and “from experienced users”)</td>
</tr>
<tr>
<td></td>
<td>Product development pattern (We mostly do system upgrades)</td>
<td>Based on previous</td>
<td>Similar to previous</td>
</tr>
<tr>
<td></td>
<td>Cost of a designer (“Designers are expensive”)</td>
<td>Based on previous</td>
<td>Similar to previous</td>
</tr>
<tr>
<td></td>
<td>Ad-hoc usability work efforts (We each try to have a usability focus)</td>
<td>Not provided</td>
<td>“Developers cannot have users’ perspectives”</td>
</tr>
<tr>
<td>Usability designer may in some cases be part of a project</td>
<td>When product is new and there is less concern over users’ familiarity of the product</td>
<td>Not provided</td>
<td>Not provided</td>
</tr>
<tr>
<td></td>
<td>To ensure the designer remains objective</td>
<td>Not provided</td>
<td>Not provided</td>
</tr>
</tbody>
</table>

### 4.3 Functionality priority claim

A second claim concerns the prioritization of functionality over usability. The mapping for this claim is summarized in table 5. As seen in table 5; the participants identified 4 grounds for the functionality claim. These include (1) the system architecture; (2) the product type; (3) the product customer profile; (4) and the lack of sufficient human resources. Only 2 of these 4 grounds have warrants. These are grounds 2 and 3 respectively. With respect to the warrant that reinforces grounds 2, participants assert that as the systems they develop are administrative and not users’
main work systems, the users of these systems are more interested in its functionality rather than its usability. Conversely regarding grounds 3, participants assert that the users of their systems are mostly experienced users who also place high emphasis on functionality. There is only one rebuttal provided by our participants which describes how they acknowledge that there are issues with the veracity of customer feedback regarding their products. This is as feedback has been acquired solely from the experienced users and they have focused on testing these users only on specialized areas of the system.

Table 5. Functionality prioritization claim.

<table>
<thead>
<tr>
<th>Claim (C)</th>
<th>Grounds (G)</th>
<th>Warrant (W)</th>
<th>Rebuttal (R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functionality</td>
<td>System architecture (“Tight coupling between</td>
<td>Not provided</td>
<td>Veracity of feedback</td>
</tr>
<tr>
<td>prioritized over</td>
<td>functionality and graphical interface”)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>usability</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product type</td>
<td>(“Administrative systems not core work systems, so users’ focus is not on usability”)</td>
<td>“Demands of usability are a little bit different when it comes to administrative systems”</td>
<td>As above</td>
</tr>
<tr>
<td>Product customer</td>
<td>(“Customers are experienced users who care</td>
<td>“Small glitches during use are not an issue for such users”</td>
<td>As above</td>
</tr>
<tr>
<td>profile</td>
<td>more about functionality”)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of sufficient</td>
<td></td>
<td>Not provided</td>
<td>As above</td>
</tr>
<tr>
<td>human resources</td>
<td>(“We do not have a usability designer”)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.4 Summary of Findings

We set out to address the dichotomy between the awareness of usability work and the failure by organizations to translate this awareness into practice. In doing so, we started with the question: What are the barriers to the enactment of usability work in organizations who demonstrate an appreciable awareness of usability work? What we found based on the Toulmin analysis are two operational barriers manifesting as ingrained practices within the organization. These are the low priority accorded to the usability designer role within the organization and high priority accorded to system functionality rather than usability. We elaborate more on these in the next section.
5 Discussion

In the following we start by discussing how suited the Toulmin analysis has been in this case, followed by a discussion on the implication of our findings.

5.1 Toulmin analysis as a tool in usability research

Usability research has been criticized for its focus on process descriptions and methods in its attempts to improve practice rather than seeking to understand practice and intervening based on knowledge acquired through empirical means [14, 26]. These deliberations have motivated the use of interviews in empirical studies of usability practice as it enables the acquisition of practitioners’ subjective opinions on usability work issues [27]. Moreover there is emerging consensus within this field on how insight into the basic values that motivate human actions can be gleaned from analyzing the language they use in communication [28]. However, the process of analyzing the data that emerges from interviews is typically time consuming and unstructured.

It is these considerations that justify the use of a Toulmin model for data analysis as it introduces simplicity and organization into an analysis process that would otherwise be deemed arduous. By revealing the motivations (grounds) for actions (claims) and the belief systems (warrants) which reinforce them, insight is given into the rationale behind individuals’ actions. Rebuttals in this sense serve to reveal the illogicalities of these actions as they shed light on considerations which weaken the arguments made in favor of these actions. Indeed the insight which emerges from a Toulmin analysis is capable of improving the practicability and efficacy of research interventions in practice in a manner that would not be feasible through the mere imposition of methods. This is because it provides a thorough understanding of practice and the reasoning behind it, that has been argued to be necessary if change is to be achieved [29].

With our study as an example, our use of the Toulmin model has enabled us to highlight the operational barriers that are responsible for the usability paradox in this case, and what reinforcers these barriers. This comprehensive view also gives insight into the issues that need to be taken into account to ensure the success of usability work interventions and their eventual sustainability in project settings being examined. Further this knowledge weighed against their rebuttals could be used by to argue for why a more strategic approach to usability should be in place in this organization. It has been asserted that usability research has failed to address issues of relevance in practice or make contributions that are practicable [26, 27, 30]. Thus examining practice in development contexts such as we have done is one way in which usability research might answer this call.

However, the limitation of mapping data using the Toulmin model is that it leads to large and complex graphical models which cannot be easily presented in research papers due to space limitations. This problem has been solved in this paper through our presenting our data in table form. The downside of this is that we are unable to depict the interrelationships between our constructs (c.f. Fig 1).
5.2 Operational Barrier – Low importance placed on the usability designer role

In the literature it has been asserted that if usability concerns are to always remain at the fore then usability designers should be a part of agile projects, and also be fully integrated into the development team [1]. Where this recommendation is not being implemented, reasons such as project and time constraints; type of development method used; and a lack of usability awareness in the organization have been cited [31]. Others include organizations’ seeing the role as dispensable since they presume it to mainly involve the application of common sense [32] or similar to requirements or project planning roles [33, 34]. However these opinions are usually from the perspective of usability designers as few studies have examined it from the organizational perspective [28]. A consequence of this has been the development of strategies to improve organizational understanding of usability [35].

Our study which examines usability from the development team perspective highlights how this argument might not always be valid, as our case organization demonstrated an appreciable awareness of usability. Further the reasons provided for their approach to the usability designer role accentuates concerns, which seen from their perspective may be deemed justifiable or rational, even if based on their rebuttals and weak warrants, implausible. For instance, if we consider organization or project size, then the approach taken by our case organization might be justified. This is as it has been suggested that the usability designer role might only be relevant in large scale projects, rather than in small size projects [36]. Another is their concern over the decreased objectivity of a designer upon inclusion into the development team, which is an occurrence that has been noted in the literature as highly possible [1]. These deliberations necessitate the need for a shift from the hitherto one sided focus on how to “sell” usability from the usability designer perspective to a re-examination of the usability designer craft and arguments made in its favor. Already we see signs of this approach being adopted in the literature with some authors calling for usability designers to strengthen their understanding of agile methods in order to improve how they are perceived in practice [37].

Conversely regarding the prevailing argument in favor of the usability designer role and them being usability advocates, there are few post system evaluation studies that have explicitly studied the impact this role has had on the finished system from users’ perspective [1]. The bulk of what exists in relation to this are mostly third party compliments cited by usability designers [3]. A limitation of our study is that we have also toed this path. However, the situation was not perceived to be an issue in the organization and we were not expected by them to intervene in the matter. Our aim was to acquire understanding, not intervention. Thus it would have been difficult to justify why we would need to interview their system users. Indeed examining users’ perspectives might have further undermined the assertions of our participants, but then we perceive this has been achieved to an extent by their admittance of the low quality of user feedback upon which they have justified their actions. Complementing with the users’ perspectives in such contexts might thus be seen as an agenda for further research, especially for those that want to argue for change.
5.3 Operational barrier – High importance placed on functionality

The distinction between functionality and usability is best illustrated by the questions these system quality attributes aim to answer. Functionality answers the question, what does the product do, while usability focuses on whether the user can use this functionality to achieve the users’ desired goals and the accompanying experience during use [38]. The importance of factoring each of these considerations during development work is one that has been emphasized in the literature due to the manner in which they are interlinked and influence system use [39]. However it has been observed that functionality concerns are often prioritized over usability in ISD projects and this has been attributed to poor understanding of usability or an inability to distinguish between usability and functionality [40].

We see these notions being dispelled again by our findings detailed in section 4.1 where the organization demonstrated an awareness of usability in their ability to provide descriptions of what usability is and how it should be executed. Further in their ability to make a distinction between usability and functionality. What their grounds and warrants reveal are concerns, some of which need to be examined further by research.

For instance our participants note the tight connection between the graphical interface and functionality of their systems. This raises the question on how usability modifications can be effected in a way that would not affect their system’s functionality. Further it calls for a reconsideration of the argument against the involvement of designers in the development of the system architecture [41]. As clearly the ability to participate in this activity would facilitate the system to be developed in a manner that would be perceived by developers to be pragmatic and would reflect the input of usability designers [35].

It also highlights the leverage customer opinion can have on the development process. Further it substantiates criticisms made against agile methods for its vagueness on the user role during development since the focus is typically on users who have the “money and mandate to decide what to buy” [42]. Thus it may be that user preference for system functionality as mentioned by our participants is a consequence of business decisions made by such users. In tandem it also accentuates concerns in the usability literature on diminished user representativeness when users are involved in the development process [1], as this might have also influenced user feedback. It has been asserted that users who are enlightened on usability issues have the ability to change the dynamics of the development process in favor of usability [43]. This assertion and the concerns we have raised make exigent the development of user selection strategies that factor in how to involve users and who to involve.

The perception held by our participants that usability is a non-issue for the expert users of their systems may be seen as a “tenacious ghost” of usability work as it is an issue whose fallacy has been noted in early usability discourse [40]. Its continued influence calls for studies that can objectify this fallacy in a form that can be appreciated within such development contexts.
5.4 Revisiting the Agile usability problem

The usability problem within agile systems development has mostly been approached from a methodological view with a focus on integration and how it can be achieved [12, 13]. In this paper we did not set out to explicitly address this issue; however our findings suggest a link between this and the level of organizational maturity with regards to usability.

With reference to ISD it has been asserted that immature processes are an indication of organizations’ failure to engage in higher levels of learning [44]. By higher levels of learning, we refer to double loop learning where the organization reflexively examines its processes and revamps its processes based on the insight acquired [45]. This differs from single loop learning where learning is superficial and focus is on maintaining the status quo (ibid). The increased awareness of usability work in organizations and their failure to engage in it might be seen as an outcome of single loop learning, and we have highlighted the barriers that could lead to the persistence of this situation.

Conversely we have noted that the focus of most empirical agile usability studies has been on organizations that are at a higher level of usability learning and may thus be considered mature. These studies have revealed the strategies which enable the facilitation of usability work in such contexts, not limited to method descriptions [13, 14]. Thus it may be suggested that where constraints to usability work are effectively managed during agile projects, it might be a consequence of their having engaged in higher levels of learning and developing a mature approach to usability work. Based on this it may be necessary to extend the discussion on agile usability by assessing the role organizational usability maturity plays in how usability work occurs in agile projects.

This discussion on status quo might also be examined from the perspective of theories on organizational decision making. Though this is beyond our scope in this paper, a perusal of the status quo bias theory [46] reveals constructs which describe some of the assertions of our participants. An example would be the uncertainty construct which as a subset of the rational decision construct captures the “fear of the unknown even in the absence of explicit costs” (ibid). This fits with our participants’ argument on the cost of designers, more so as the organization has never had a designer as a full time member of the development team. Indeed contextual considerations need to be taken into account in empirical studies of agile usability and in the recommendations that emerge from these [1, 14].

6 Conclusion

We examined the reasons why usability work despite its high awareness might not be executed in an organization. We found two operational barriers in place, which based on their justifications, were multifaceted. The barriers were related to (i) low importance of the usability designer role, and (ii) high importance of system functionality. These barriers are refutable and accentuate the need for a revamp of the organizations’ existing processes. In tandem they also negate some assertions
regarding usability work in the literature. A further consequence of our findings relates to agile usability studies where we have suggested a broader focus on the role played by contextual considerations such as the level of usability work maturity. These are issues that need to be examined further.

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References


Enterprise Architecture in the Public Procurement of Information Systems

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Abstract. Enterprise architecture (EA) can be used to bridge the gap between business and IT. In Finland, the Finnish public sector has adopted the EA as a methodology to create interoperable and efficient IT systems that enable and support the new ways of working needed to increase public sector productivity. An essential and unavoidable phase in developing such IT systems is the phase of public procurement. We took a sample of public sector call for tenders and analyzed them in order to find out, how the newly adopted EA methodology and framework manifests itself in the public procurement documents. Additionally, we discussed the potential benefits of the EA methodology to the procurement phase of the IT system development. The results looked promising as the EA was prominent in several of the call for tenders. The documents gave insight into the different ways with which the EA methods may aid the procurement.

Keywords: enterprise architecture, public sector IT, public procurement

1 Introduction

Enterprise architecture (EA) can be described as “the organizing logic for business processes and IT infrastructure reflecting the integration and standardization requirements of the company’s operating model.” [11] The EA methodology has been taken into use also in the public sector in several countries [3, 8]. The interoperability requirements and the strive for centralized IT governance have been the motivations in adopting the EA methodology in the Finnish public sector organizations [12]. The Finnish Ministry of Finance passed a legislation in 2011 mandating the use of EA in the whole public sector IT function in Finland.

The public procurement of IT systems is an essential part in realizing the architecture decisions and plans. Every information system purchased by the public sector authorities must undergo the public procurement process under the EU rules [13]. The procurement of the IT systems has received public criticism due to the failed public sector information system development projects that have been in the news also in Finland. The development of the information systems is thus under scrutiny of the authorities [15]. Much of the critic is focused on the fact that the information
systems are not interoperable. Furthermore, system maintenance costs are spent on integrating the systems into each other.

Because the rationale for adopting the enterprise architecture methodology include the needs of standardization and integration, the EA methodology should have something to offer also in the procurement phase of the IT system development. Thus, we took a sample of public IT system call for tenders, and analyzed them in order to find out, how the newly adopted EA methodology and framework manifests itself in the procurement documentation. These findings can help to develop the public IT procurement as well as the enterprise architecture work in the Finnish public sector. Additionally, the findings can be useful also in other nations, where the use of EA is under consideration or underway.

This paper is organized as follows. First, a brief introduction to the Finnish public sector EA and public IT procurement is presented. Second, the research setting and methodology is described. Then, the findings are listed. The paper ends with discussion and conclusions.

2 Background

2.1 Procurement of public IT systems

Public procurement is used to acquire goods and services to governmental and public organizations, such as municipalities. The goals of the public procurement are to use the public funds to acquire goods in impartial, transparent way so that the procurement effectively uses the different possibilities available in the market [12].

The call for tenders in the public procurement must contain enough information for the potential suppliers so that they can make competitive bids. Essential part of the call for tender is the requirements specification attached to the call for tender. Research has shown that producing the documentation for the public procurement is a demanding task. It is a difficult task to specify the requirements for an information system in an open bid [9]. The use of Enterprise Architecture has been a solution for some of the problems as the EA could harmonize information systems and thus reduce the need for producing documentation for procurement by enabling the re-use of documentation created [7]. Interoperability of IT Systems has been one of the main rationales for adopting EA methodology in Europe and USA [2].

2.2 Enterprise architecture in Finland

The Finnish Enterprise Architecture framework is presented in the national enterprise architecture framework recommendation called JHS-179 [4]. The recommendation is about to become a public ICT standard, and the legislative work is currently under development. It will be mandatory for the public sector ministries and organizations to make their own enterprise architecture descriptions, as mandated by the Act on the Direction of Public IT Governance that came into effect on September 1st, 2011.
Thus, Finland has adopted a model where the use of EA framework in the public sector is enforced by using legislative and normative means. The Finnish national EA framework is based on simplified TOGAF9 framework [14]. The EA governance model has been developed separately but the governance model does not yet have a recommendation status. The framework consists of the four architecture areas – business, data, application and technology architecture – and the concept of current as-is and the desired to-be architectures. The JHS-179 gives recommendations on how to create and describe the enterprise architecture descriptions of the organization with notations like BPML and ArchiMate. The JHS-179 framework has been further developed an amended with the Kartturi framework [5].

2.3 Procurement of IT systems in Finland

The Finnish government and its institutions spend annually approximately 650 million EUR for purchasing IT systems and services. Of these costs around 500 MEUR are used to purchase services, and roughly 150 MEUR to purchasing or leasing devices [10]. When the wages and other costs are added, the information management takes roughly 1.5% of all governmental spending in the year 2011.

All public IT projects are subject to the public procurement method as mandated by the EU rules [12]. The only exception for this rule are the small procurements under the threshold of 30 000 EUR. Thus, the successful public procurement is one of the key elements in creating information systems that enable the government to increase its productivity.

3 Research setting and methodology

The goal of the study is to find out, how the newly adopted EA methodology and framework, JHS179, manifests itself in the procurement documentation. The public procurement documentation was selected as the target of analysis. The public call for tenders are publicly available and they represent a sample of all IT development work currently ongoing in the public sector. The research hypothesis is that if the EA development work is ongoing in the public sector, it should be visible in the call for tenders. Furthermore, the public procurement is the mandatory step in realizing the planned Enterprise Architecture of the public organization.

The public tenders were collected from the Finnish national procurement portal, Hilma1. The calls for tenders were first filtered by their CPV-code [1], in this case the CPV code division 72000000-5, whose subcategories contain all the IT services purchased by the government. This leaves the call for tenders containing only hardware out of the analysis, as well as very specialized equipment that are not listed under the IT services code.

Content analysis was selected as the research method [6]. The time period in which the calls for tenders were collected was from October to November 2012. In this

1 http://www.hankintailmoitukset.fi
3.1 Analysis framework

In the research the existence of Enterprise Architecture is researched from two viewpoints. Firstly, the explicitly mentioned terms related to the Enterprise Architecture are noted. Examples of these are terms from the Enterprise Architecture Framework such as different architecture areas or other terminology directly from the JHS-179 framework. Terminology may be also images and flowcharts, when it is evident that the structure given in the EA recommendations is used.

Secondly, if the EA-specific terminology or methodology is not present, the four architecture areas (business, data, application, and technology) and the notion of the as-is, to-be and transition phases is noted.

If an architecture area was mentioned by name in the call for tender, it was interpreted as addressed. If the EA framework and methodology was not used, the existence of a named area was interpreted from the call for tender. If the it contained explanations or requests about what the system under procurement is intended for, who are the users, or what kind of processes will be served with the system, the business architecture were considered as present. Data architecture was considered present if the call for tender contained entity relationship models, or either concept-level or detailed explanations of the data that the system will be processing. Application architecture was present names of the systems with which the system under procurement will be integrated with were mentioned or similar information of the application architecture of the purchasing organization was present. Finally, technology architecture was interpreted to be present, if technologies were named or requirements about the technology environment of the system were present.

The existence of as-is and to-be architectures were interpreted to be existing either when the specific terms were used or when there was a presentation of the current state of the IT systems or the state of the system after the procurement and implementation, respectively.

3.2 Selection of the call for tenders

In the first phase the call for tenders were briefly analyzed. In this point it was found that not all of the calls for tenders were fit for the content analysis. Thus, the first task of the analysis was to select the call for tenders to the content analysis phase.

The total count of call for tenders collected during the period of October and November of 2012 was 35. One of the calls for tenders was for licenses of a specified computer program, even though such kind of procurement does not directly fit the selected CPV-code. There was one call for tender, subject of which was a framework agreement containing security apparatus and services. As the purchasing organization was different than the actual end users, the call for tender was left out of the analysis. Two of the calls for tenders were asking for work resources with only a brief
description of the task at hand, and it was not possible to evaluate the existence of enterprise architecture from the documentation included in the call for tenders. Finally, there were six calls for tenders that documented such a limited view for the system under the procurement that the content analysis could not be made from the documentation attached.

Thus, the total number of tenders that could be analyzed using the analysis framework was 25.

4 Findings

4.1 Enterprise architecture framework in CFTs

The existence of the enterprise architecture framework is summarized in the Table 1.

In the procurement process the suppliers have a chance to present questions to the purchasing organization. The answers to these questions are published to all interesting parties, often publicly. These answers were also included in the analysis when they were publicly available.

The term architecture was mentioned in the call for tenders in various contexts. Architecture could mean the inner software architecture of the system under purchase – such as the tools used in the development, multi-tier architecture of the system or the use of Service Oriented Architecture (SOA). In those cases where the Enterprise Architecture framework was used the architecture terminology was more consistent across the different call for tenders. In these cases it was considered whether term architecture in the call for tender encompasses all the enterprise architecture areas, only one of them or if the term was used in a completely different context that did not have connection to the enterprise architecture framework.

The existence of different architecture areas are presented in Table 2. The technology architecture was most prominent in the call for proposals. The frequency with which the other architecture areas existed in the call for tenders was roughly the same, and approximately half of the existence of technology architecture.

Table 1. The existence of EA terms and different enterprise architecture concepts in the call for tenders.

<table>
<thead>
<tr>
<th>Element</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyzed call for tenders (CFT)</td>
<td>25</td>
</tr>
<tr>
<td>CFTs that used EA framework or terms</td>
<td>6</td>
</tr>
<tr>
<td>CFTs with business architecture concepts</td>
<td>12</td>
</tr>
<tr>
<td>CFTs with data architecture concepts</td>
<td>9</td>
</tr>
<tr>
<td>CFTs with applications architecture concepts</td>
<td>11</td>
</tr>
<tr>
<td>CFTs with technology architecture concepts</td>
<td>21</td>
</tr>
<tr>
<td>CFTs with as-is architecture concepts</td>
<td>4</td>
</tr>
<tr>
<td>CFTs with to-be architecture concepts</td>
<td>5</td>
</tr>
</tbody>
</table>
Table 2. The existence of EA architecture areas in the different call for tender groups

<table>
<thead>
<tr>
<th>Architecture area</th>
<th>CFTs with EA</th>
<th>CFTs without EA</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business architecture</td>
<td>5</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td>Data architecture</td>
<td>4</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>Applications architecture</td>
<td>5</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>Technology architecture</td>
<td>6</td>
<td>15</td>
<td>21</td>
</tr>
<tr>
<td>As-is architecture</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>To-be architecture</td>
<td>4</td>
<td>1</td>
<td>5</td>
</tr>
</tbody>
</table>

4.2 Call for tenders using the EA framework

There were six (6) call for tenders out of the 25 that used the terminology of the Finnish national Enterprise Architecture framework. When analyzed, these call for tenders clearly formed two distinct approaches on how to use the EA methodology in the documentation.

In the first group of call for tenders using EA framework, the framework was used in the call for tender structure. This was the case in four out of the six calls for tenders using the EA framework. Typically this was done in the requirements specification annex of the call for tender. This meant that the structure of the requirement specification was directly borrowed from the EA framework, and the requirements specification was structured in the way presented by the public recommendations. Some of these call for tenders used the amended Kartturi framework. By using the framework and accompanying material the different architecture areas are automatically included. In addition, the distinction between the as-is and to-be architectures were presented.

In the second group of call for tenders the EA framework was referenced by attaching the enterprise architecture documentation of the organization to the call for tender. This was the case in two calls for tenders. In these cases the architecture documentation was partial and contained high-level principles governing the IT systems of the organization, including the system under procurement. The actual requirement specification was a separate documentation that was not linked to the EA documentation. The architecture principles were tentative and the supplier could make own interpretation of the principles.

4.3 Call for Tenders without Enterprise Architecture Framework

The call for tenders that did not have any reference to the Enterprise Architecture framework still often had the same elements in the call for tender than the ones using the EA framework. The technology architecture was usually clearly presented. In most cases the technology architecture part included operating systems requirements, identity management systems, and integration principles such as use of SOA
technologies and so on. The supported browsers and client environment were also mentioned often.

The other architecture areas were addressed in only half of the call for tenders when compared to the technology architecture. The existence of different architecture areas depended heavily on the type of the system under procurement. If the call for tenders was crafted so that it expected tenders of productized solutions, such as servers or software products, typically technology and application architecture was most often present. Business and data architecture were mentioned only few times.

On the other hand, if the system under procurement was expected to be tailor-made software solution, or at least the project involved custom software development, the business and data architectures were most often present. In these cases the application and technology architectures were less prominent in the call for tenders.

5 Analysis

5.1 The role of the Enterprise Architecture in the Call for Tenders

There was a clear distinction with the call for tenders that actually used the EA framework in the requirement specification of the system and the call for tenders that only referenced higher level architecture principles of the organization.

The calls for tenders using the enterprise architecture framework as a structure show that the EA methodology and structure is suitable for also other purposes than the organization’s enterprise architecture generation. The EA methodology produces clear specifications where the different aspects of the procurement can be systematically and consistently addressed. In these cases the EA terminology is an elementary part of the requirements specification structure in the call for tender.

One of the most problematic issues is related to the interpretation of the architecture guidelines. Is the guideline mandatory one that has to be followed, or can the supplier deviate from the guidelines if the supplier can produce rational arguments that support the deviation? In case of a public procurement this is an elementary distinction – in the former case if the supplier can not show that it can follow the guidelines, the supplier is ruled out of the competition. On the other hand, if the guideline is not mandatory, how will the different options be evaluated and ranked?

If the EA principles and documentation is merely attached to the call for tender, they still provide valuable information about the organization’s structure, roles, data and IT environment. In this case the role of the EA documentation in the procurement is purely informational. It gives insight to the supplier of the organization’s infrastructure and future development. If the organization making the procurement wants to favor those solutions that are most compatible with the organizations enterprise architecture, the scoring mechanism for the procurement must be created carefully.
5.2 Benefits of the Enterprise Architecture in Call for Tenders

Several benefits of the EA methodology can be seen from the call for tenders. Firstly, the enterprise architecture framework can be used as a checklist for the call for tender. If the enterprise architecture framework is used, all the different architecture areas are automatically addressed. The enterprise architecture documentation can also be used as informative documentation, whose role in the call for tender material is to bring background information of the organization to the supplier.

Secondly, the EA framework forces the organization making the procurement to specify the current status of business processes, processed data, information systems and used technologies both currently and the desired state of the respective areas in future. This element was often lacking in the call for tenders that did not use the EA architecture. Table 2 shows that the concepts of as-is and to-be states is not intuitive if the EA methodology is not used. There was only one call for tender without that did not use the EA framework, where the distinction between those two states was described. This can be seen also from the questions that the suppliers presented to the buying organization. A few times the questions included an enquiry of whether this is a replacement purchase or a completely new system. This information would be readily available, if the enterprise architecture descriptions of the organization would be present.

The role of the EA framework in creating common terminology and vocabulary to the procurement of IT systems can also be raised. The call for tenders using the EA framework used much more consistent vocabulary and terminology, e.g. in the context where the term 'architecture' was used, when compared to other call for tenders. This could help also to bridge the terminology gap between purchasing organization and the suppliers participating in the procurement.

6 Discussion

The research question was, how the newly adopted EA methodology and framework manifests itself in the procurement documentation. The simple answer to this question is yes – several call for tenders directly used the national public sector EA framework published 18 months prior to the collection of the data. There was large variation in the usage of the EA architecture. It cannot be deduced from this material, whether the reason is the different pace with which the organizations adopt the EA framework, different organization models of the EA development or some other reasons not yet detected. In order to find this out from the call for tenders, enough material should be collected so that there would be several calls for tenders from every major public body. Another possibility to approach this question is by either interviews or surveys targeted to the public sector officials.

An interesting finding is that EA is most beneficial in the procurement as a tool. Merely attaching the current EA documentation of the organization is not sufficient to fully describe the wishes and goals of the purchasing organization. One aspect here may be that the call for tender is written by the officials responsible for the purchase, whereas the organization’s enterprise architecture can be developed by a separate
group of enterprise architects. This is an interesting fact that can be researched further by interviews or questionnaires.

Another fact affecting the usage of EA architecture could be the nature of the procurement. It could be argued that when the stakes are high and the system under purchase is expensive (e.g. several million EUR), also the procurement is under much more scrutiny and more time is spent in making the requirements specification. However, the material in this study does not immediately support that because there were quite small call for tenders (estimated or expected value under 100 000 EUR), where the EA framework was still successfully used.

Finally, it could be interesting to find out, how the EA framework fits different kind of procurement types. In the sample there were IT systems that are deployed in-house and whose ownership will be transferred to the buyer (custom-made software), systems that are bought as licenses and also purchases of SaaS-model services. All of these have different implications to the enterprise architecture of the organization.

7 Conclusions

Much of the development of the public sector work and processes is done with the aid of information systems. The new information systems in the public sector increase the productivity, provide transparency to the administrative processes and enable the citizens to interact with the public sector officials. The implications of the information technology to the public sector administration are becoming visible as the public sector launches new e-government services that ease the routines of both officials and customers of the public sector.

Essential part in the gaining of these benefits is that the information systems must be developed so that they serve their purpose, offer satisfactory usability, and assist in creating new ways to interact between officials and citizens. This has been one of the key rationales behind the adoption of enterprise architecture methodology in Finland. Still, the implementation of the EA principles is not enough – the information systems must go through the procurement phase so that the end result of the information system acquisition is the one that was desired in the first place.

This research shows that the EA methodology has much to offer to the public IT systems procurement. Already in the early stages of the adoption of EA methodology the benefits can be observed from the call for tenders. The analysis made in the research helps to identify the areas where EA methodology could be used more in the future. This could be done by collecting the new ideas and experiences and distributing them in the public sector officials involved in the public IT procurement.

The research also raises new questions. What are the reasons behind the variations of EA methodology usage? Can it be attributed solely for the different phases with which the organizations conduct their EA work, or are there other reasons behind the differences? The research can be extended both in time and in scope. The same analysis can be repeated in order to find out, whether the assumption of different phases of EA adoption is correct. Furthermore, the size of the sample was too narrow to make any definite conclusions about the rate of EA adoption. The research could also be linked to research of public sector procurement made in other countries.
References

A model for visualizing inter-team interaction patterns influencing speed development in large software companies employing Agile Software Development

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Abstract. To achieve successful business, large software companies employ Agile Software Development to be fast and responsive in addressing customer needs. However, a large number of small, independent and fast teams suffer from excessive inter-team interactions, which may lead to paralysis. We provide a model of such interactions to give information to the teams in order to react upon it, and we find a major challenge in ASD to collect data for an effective visualization of the information.

Keywords: Agile software development, inter-team interaction, speed, large scale software engineering, model, information, visualization.

1. Introduction

Large software industries strive to make their development processes fast and more responsive with respect to customer needs, minimizing the time between the identification of a customer need and the delivery of a solution. An open issue is how to scale Agile Software Development (ASD) from successful small software projects [1] to large software companies. One successful approach is to split the products in components and features and to parallelize the development using small, fast teams [3]. However, such approach brings the drawback that a team requires interaction with many other teams [19]. The support for such interactions with a high number of teams or with the surrounding organization in Agile methods is weak and not well explored [13]. Some studies highlighted how interaction issues often cause inefficiencies [2],[6],[25],[22], and hinder the speed benefits gained by the parallelization of the development [25]. Also, delays in interaction due to synchronization may turn fast individual teams into slow and frustrated teams constantly forced to wait for others, hindering the fast release of features [3].

There may be several reasons why the teams lose time to interact and to carry out tasks related to such interaction. This speed waste decreases their interaction speed and therefore their overall speed. How could the teams visualize such interaction speed in order to react? What interaction patterns are influencing speed?
The purpose of this study is to identify the key properties to model the interaction patterns in order to visualize interaction speed.

The research questions addressed in this paper are the following:

**RQ1** How can we model interaction patterns to visualize inter-team interaction speed in large software organizations?

**RQ2** What instruments could we use to reveal interaction patterns in ASD?

The paper investigates these questions through a multiple-case case-study with three software companies employing large scale ASD. We conducted exploratory group interviews, followed by qualitative data analysis, and member checking sessions.

Our contributions are:

- We define interaction patterns and key properties of interaction.
- We highlight major challenges in ASD to reveal interaction patterns.

In section 2 we explored the literature, in section 3 we describes our theoretical framework that defines our notion of interaction speed. Section 4 describes our research design, section 5 our results. Then we discuss the applicability of our results (Section 6) and the limitations of the study (section 7). The paper ends with our conclusions, in Section 8.

2. Literature review

When surveying the literature, we have found a constant dilemma between, on the one hand, the need to create fast and independent Agile teams [3] and, on the other hand, the need to increase inter-team communications [12]. We found important to understand what interactions are affecting speed and what the causes are. Researchers in Global Software Development have studied interaction problems with the focus on geographically distributed teams [13,12,18,19]. Recommendations found in [12] (Optimally Splitting Work across Sites, Increasing Communication, Finding Experts, Awareness) have shown to be important also in large organizations that are considered co-located. This suggests that in large software organizations, even if co-located, the size of the project creates some of the effects as the geographically distributed teams. Therefore, our research may be of value for GSD and vice-versa. In [7] the authors studies how knowledge management affects the coordination of teams. A critical characteristic of ASD in interactions is the informal communication: it has been considered of value for managing volatile requirements, which makes the development flexible but creates challenges for inter-team communication and coordination [17]. In [18] informal communication is suggested as working well for XP with a strong bridgehead between the teams.

A socio-technical framework for evaluating technical and work dependencies has been studied in [4]. However, such framework heavily relies on artifacts representing the ongoing interactions among the employees, which requires reliable artifacts. Such artifacts are not available and are not representative in an informal ASD environment. Thus we found important to understand the interactions in such an environment.

Most of the abovementioned works study only parts of the problem from several perspectives. In [25] the focus is similar to ours, but the studied impact of Agile
practices in communication is not related to speed and business goals. Our framework provides a set of factors-effects affecting speed, and recommendations to handle such factors that we haven’t found in literature. The research in social psychology presents an opposite perspective on speed and interactions, in which time boundaries are claimed to influence group performance and interaction process [15].

3. Theoretical framework

Our theoretical framework is based on an initial a priori framework, which has been continuously updated during the study and the analysis of the data [5]. We define speed (borrowing the concept from kinematics) as the amount of the delivered value (DV) divided by the value delivery time (VDT): the time between the perception of a need and delivery of value by some external party. (See fig. 1). VDT is divisible into the time to identify the party (t_N), time until call for action (t_A), the time to commitment (t_C), and the time to delivery of value by the external party (t_D). We define speed as the amount of the delivered value (DV) divided by the value delivery time (VDT): the time between the perception of a need and delivery of value by some external party. (See fig. 1). VDT is divisible into the time to identify the party (t_N), time until call for action (t_A), the time to commitment (t_C), and the time to delivery of value by the external party (t_D). We recognize the special case of end-to-end speed, where the need is perceived by a customer and the value delivered by a supplier.

![Fig. 1. The definition of speed](image)

A company that seeks to optimize its return of investment of R&D (ROI of R&D) must manage three end-to-end speeds (Fig. 2). The speed with which customer needs lead to new product offers (1st Deployment speed), the speed with which new features are replicated in new products (Replication speed), and the speed with which change request to an existing product are realized (Evolution speed). End-to-end speeds, in turn, depend on interaction speed: how fast teams (or other organizational units), resolve each others’ needs. (Fig 3). Interaction speed relates to both inter-organizational interaction (e.g., between teams at the customers and the client side) and intra organizational interactions (e.g., between a product management team and a team in a design unit). Each interaction involves several sub-interactions that address sub-needs, and also third party teams.
Interaction speed depends on a number of organizational, architectural, and individual factors that may or may not be managed (Fig. 2). To optimize ROI of R&D we must 1) understand what these factors are, and 2) find strategies to manage them.

In this paper we focus on recognizing the interaction patterns affecting on VDT (we assume to have a fixed DV to be delivered, i.e. a set of features). We say that a factor (1…m) generates speed waste if it is either causing one or more interaction patterns (1…p), which in turn increment VDT decreasing speed (Fig 4). The total speed waste (W) is the sum of all such speed wastes.
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4. Research Design

We planned a multiple-case case study with engineers and managers in product developing organizations. Our unit of analysis is the cross functional agile team and the phenomena of interest the interaction speed from the perspective of such teams.

Case Selection: To bring out the complexities of interaction, organizations were to be product-developing companies, with significant maintenance activities, and at least 100 developers. The companies studied were to have several years of experience of ASD. The cases chosen were three large companies with extensive in-house embedded software development. All were situated in the same geographical area (Sweden), but they were active on different international markets. For confidentiality reasons, we will call the companies A, B and C.

Case Description: Company A was a manufacturer of telecommunication systems product lines. The customers receive a platform and pay to unlock new features. The organization was split in cross-functional teams, most of which with feature development roles. Some of the teams had special supporting roles (technology, knowledge, architecture, etc.). Most of the teams used their preferred variant of ASD (often Scrum). Features were developed on top of a reference architecture, and the main process consisted of a pre-study followed by few (ca. 3) sprint iterations before the feature was deployed.

Company B was a manufacturer of utility vehicles; the team developed a communication subsystem for one of their product lines. In this environment, the teams were partially implementing ASD (Scrum). Some competences were separated, e.g. System Engineers sat separately. Special customers requesting special features drove the business, and speed was important for the business goals of this company.

Company C was involved in the automotive industry. Some of the development was done by suppliers, some by in-house teams following Scrum. The surrounding organization was following a stage-gate releasing model. The team we studied developed in-house software, served some projects with different releasing deadlines.

Data collection: data collection was structured in three phases: initial workshops with participants from A, B and C; focus group meetings; validation sessions for reviewing the results.

In the first phase, we conducted semi-structured group interviews with team members (developers and architects), line managers and process specialists. Interviews included participants with mixed roles and revolved around Figures 1-3.

In the second phase we ran 3 focus groups, one for each company. We studied the phenomenon from the team perspective. We included senior developers, team leaders, architects and testers. In this phase we focused on extracting the main factors that were causing or influencing interaction speed. We ran the focus groups separately for each company. We discussed the problem by using models 1-3, then we asked the participants for situations in which the team was suffering from interaction and finally we injected the information from the previous sessions.

In the third phase, after the data analysis, we ran an interview session for each company for validation purposes. Some of the same participants were involved in this process, to adjust researcher’s representation of the data. Finally, a short validation workshop with 2 employees from all the companies was conducted.
Data Analysis: After each session we analyzed the recorded interviews to develop models and first results to be discussed in the following sessions. The analysis of the data was carried out between the phase 2 and 3 and also afterwards, to refine the results. We inductively further developed the initial theoretical frameworks and we populated them with interaction patterns and properties.

Synthesis: On the basis of this analysis and suggestions by the informants in interview data, we created a model for representing important interactions.

5. Findings

In this section we present our results: we describe a model to characterize interaction patterns and we highlight the lack of documents in ASD to track interactions among teams.

Interaction patterns

In Fig. 5 we show the general model for interaction between two teams. We relate the interactions to time, which is the main variable to measure speed.

![Diagram of interaction patterns](image)

**Fig. 5.** Interactions, sub-interactions, and interaction speed

An interaction starts when one or more members of a team (Team 1 in the picture) experience a need (at a time \( t' \)) that cannot be satisfied using the resources within the team. One or more member of Team 1 establishes a contact (interaction \( i_1 \)) in the picture with another member of Team 2 (for simplicity we will mention Team 1 and Team 2 instead of citing a specific member). The interaction ends with the delivery of a value (see below for more details about values) from the other team (Team 2), which is represented by \( i_k \) at a time \( t'' \) in the picture. We refer to these two interactions (\( i_1 \) and \( i_k \)) as main interactions. Between the time span defined by \( t' \) and \( t'' \), the teams may have other interactions, for example to agree on the final delivery of the value. We call these interactions secondary interactions, since they are
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necessary to adjust the main one. The granularity of main and secondary interactions may vary depending on what we consider to be the need and value delivered: for example, the interactions $i_2$ and $i_3$ in the picture may be considered recursively as need and delivery of a sub-value which would be necessary for the value delivered through $i_k$. In the same way, the need and delivery ($i_1$ and $i_k$) may be considered as secondary interaction when considering the integration of more values as a whole. An example may be the need and delivery of a set of functionalities included in a feature (someone, for example a management or business team, needed the feature in the first instance and communicated a need to the team).

Values delivered can be of various natures, anything that is needed by the team for continuous working on the current development of a specific feature or component. We provide an example mentioned during the interviews:

- A feature $f_1$ developed by Team 1 has a dependency to another feature $f_2$ developed by Team 2. For example, Team 1 has to change something in a component that will change the behavior of the feature $f_2$. In order to agree on the change, Team 1 contacts Team 2 expressing the need to change the shared component ($i_1$). After some agreement steps ($i_2$ – $i_{k-1}$) on how to change it (for example, negotiating the change of an interface), Team 2 approves the change (in the picture, the delivery $i_k$).

The model in Fig. 5 can be combined multiple time involving different interactions between other teams, for example in Fig. 6 we have added the interactions between Team 2 and Team 3 to the model showing the interaction between Team 1 and Team 2. The resulting model could show the indirect interaction between two teams (in this case, the interactions between Team 1 and Team 3). Indirect interactions are often hidden, causing frustration for complex communication causing delays without the team being aware of the root cause. If all the teams were included in the model, the final display would highlight a complete landscape of the interactions going on among the teams, which could be used to reveal multi-interactions patterns and therefore to understand where the bottlenecks and the unnecessary complicated communications are. The combination with tagging would also show which activity is critical for interaction. In our case, the tagging could be combined with the identified

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**Fig. 6.** Interactions, sub-interactions, and interaction speed
factors [12]. Finally, tasks generated by interactions can be considered as additional time spent on the interaction itself and therefore contributing to the final delay.

In the following, we will use special cases (or instances) of this generic model to represent interaction patterns that may occur in practice.

**Interaction properties**

The interactions among the teams may have different properties, which may have an impact on time:

- **Synchronous/asynchronous:** interaction between teams can be synchronous or asynchronous. In the former case, both the teams (or members of the teams) are participating in the interaction simultaneously, from the (sub-) need to the (sub-) delivery. An example of this kind of interaction is a phone call, (some) instant messaging conversation, a meeting or a workshop. An asynchronous interaction takes place when the need is communicated and the answer is received later, but the time in between is not part of the interaction. An example would be an e-mail conversation, a change request, etc., but also a request for more interaction. Even though we can’t associate a time span for the asynchronous interaction itself, we can safely assume that some amount of time is still required to carry out an asynchronous interaction (for example the activity of writing an e-mail or to fill in a document).

- **Blocking interaction:** an important kind of interaction is the blocking interaction. This is due to a critical need that has to be satisfied in order to continue the task at hand for Team 1 (Fig. 7). Although the team could probably (but not necessary) work on something else during the waiting time, the total length spent on the task will be increased, delaying a related release. When the interaction is synchronous, it becomes automatically blocking since both the involved teams are actively and continuously participating in the interaction until the need is delivered (for example, a workshop ends).

- **Interaction frequency:** the interactions may consist of just one with a lot of time spent on a single delivery and a single value, or it may consist of many (smaller) interactions. In fact, a huge delay may be easily recognized as a long waiting time, while many shorter interactions are more difficult to
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...catch, and in the end the time spent (and therefore the delays) could be equivalent to a single, long interaction. For this reason, we introduce the interaction frequency, which can be calculated as $k/(t'' - t')$ in two ways, depending on the kind of interaction:

- by considering each interaction as independent, which would include all the interactions (Fig. 5);
- by considering a need $n_j$ and a delivery $d_j$ as a whole interaction ($1 \leq j \leq k$ in Fig. 8). This frequency makes sense in case we have synchronous interactions (since every need cannot be separated from the delivery).

![Fig. 8. Interactions, sub-interactions, and interaction speed](image)

- Interaction density: it represents the amount of time spent in interactions over time. It is calculated by summing up the various lengths of interaction divided by the time span. This property is relevant when considering blocking interactions (and thus also synchronous interactions). However, we can suppose that for each asynchronous interaction some small amount of time is spent on the activity of interacting, and therefore intensity can be approximately calculated.

Challenges in monitoring interaction in ASD environment

We have found very difficult to keep track of the actual interactions going on in the companies. The means to track communications, coordination and other sources of interaction were not present in the organizations, or they were not representative of the real events. This means that the observation of artifacts such as documentation couldn’t be used to understand the actual behavior of the teams. This status was confirmed in all the 4 units (3 cases) studied, which is quite strong evidence. Moreover the introduction of ASD, supporting the practice of informal communications over documents, sustained this situation. We cannot claim, though, that it is the root cause, since we don’t know about the situation previous to this change in the processes.
6. Discussion

In this section we explain why our results are relevant for the software business, how the factors can be discovered and how recommendations can be applied by practitioners (managers or teams).

As explained in [22] and in Fig. 2, there are three end-to-end speeds influencing Return of Investment: 1st deployment speed, replication speed and evolutions speed. Interaction speed affects all of them, as explained in the following paragraphs.

- **1st Deployment Speed**: when a set of features is released for the first time, the speed is affected by the interaction speed among the teams that have to integrate the features. This kind of speed helps *hitting the market fast* to anticipate the competitors. Fast deployment speed also *shortens the loop in market testing*.

- **Replication Speed**: when a feature is embedded in a previous release, interactions are needed between the team responsible for the new features and the teams that had developed the former ones. Replication increases ROI when the effort made for the 1st deployment speed is spread on the *release of new products and services based on the existing software*.

- **Evolution Speed**: when a feature needs to be changed after its release, such changes will affect other features, requiring interactions again. The speed in *reacting upon a change request* can be critical for gaining the trust of the customers.

Managers want to reach the abovementioned business goals. Delays over the schedules may be due to speed wasted in interactions. Managers may recognize it but they need the team(s) to observe the effects. The effects can be visualized in form of *interaction patterns*. Since each effect is related to one or more root factors, managers can immediately investigate the status of such factors in the teams to find which one is the cause for the effect. In Table 2, the connections between factors and effects reduce the solution space for the investigating manager, who saves time and resources. In case the factors are recognized, both the team and the manager (depending on the factor) may decide to react. This process is outlined in Fig. 5.

![Diagram](image)

**Fig. 9.** How the practitioner can use our results.

The importance of the model that we have described should be used in order to measure speed. The main purpose, would be the creation of a tool for digitally visualizing interaction patterns among the teams, which could therefore act upon the shown information. In [23] we have listed factors producing effects and causing speed
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waste. To recognize such effects, though, the team and the managers need a suitable tool for the visualization. We have listed the properties for such model: however, there exist challenges in an ASD environment that hinder the collection of informative artifacts.

7. Threats to Validity and Limitations

In this section we list and explain the limitations for this study. The information is based on employees’ statements and may be biased. One possible threat to validity is the evaluation apprehension: the employees were interviewed usually in groups, which helped balancing statements. To handle the mono-operation bias we collected data from three companies and in some cases from more than one site. As for background influence, we interviewed various roles, from managers to programmers. We limited the threats to conclusion validity (such as influence posed on the subjects) by injecting the preliminary results only after the respondents gave their statements. The threat to external validity (generalizability) has been limited (but not completely solved) by studying three cases with common attributes: size, development domain (i.e. embedded systems) and introducing ASD. We highlighted the differences in the section about their contexts.

8. Conclusions

The effective implementation of ASD in large software companies may be the way for the successful achievement of business goals depending on speed. However, Agile teams need to recognize interactions and act upon such information. We have defined interaction speed through a set of models, to frame it with respect to large organizations employing ASD. We have created a generic model and listed properties of interactions (RQ1). We have highlighted what problems there might be in an ASD environment to measure interaction speed (RQ2).

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References
Antonio Martini, Lars Pareto, Jan Bosch


Assistive Technology For Totally Blind – Barriers to Adoption

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Abstract. Assistive technology for people with disabilities has improved. Adoption and usage of assistive technology has been positively analyzed by various researches. However, the negative socio-psychological attributes that hinder technology adoption has not been emphasized very much in academic research. Highlighting and discussing these attributes can help in improving assistive technology adoption. Using perspectives drawn from interviews of blind users heavily reliant on assistive technology, this paper details the impact of socio-psychological barriers in assistive technology usage for completely blind people.

Interview responses add credence to the original literature findings which indicate that certain socio-psychological attributes in the case of totally blind people are barriers to assistive technology adoption and usage. The results highlight need for further research to understand these attributes in case of low to medium intensity users of assistive technology. The results also contribute toward expansion of current technology adoption models to give them an increasingly balanced outlook.

Keywords: Assistive Technology Adoption, Totally Blind People, Socio-Psychological Attributes

1 Introduction

Studies have highlighted the importance of conventional technology in order to improve overall quality of life, also through the use of virtual [1] or mobile technology [2]. Conventional technologies have enabled many new service offerings and care and cure methods in health care, even in the case of patients with severe medical conditions [3]. The most important technologies include electronic health records [4] and mobile health care applications [5].

There is little differentiation between technologies in general and assistive technology, all technology is assisting humans in their life. However, in health care the term “assistive technology” has often a special meaning. Riemer-Reiss and Wacker [6] have said that “assistive technology devices enable individuals with disabilities to participate in society as contributing members”. Advancement in assistive technology has provided better enablement of improved quality of life for people with disabilities [7], [8].
Within the last decade, various assistive technology adoption models have highlighted attributes that have an impact on assistive technology adoption for people with disability. These models include Human Activity Assistive Technology (HAAT) [9], Needs, Analysis and Requirements (NARA) [10], USERfit Method [11], Matching Person to Technology (MPT) Model [12] and the Comprehensive Assistive Technology (CAT) model [13].

The CAT model provides a comprehensive overview of targeting needs and desires for assistive technology adoption, and was originally used as a base-model to examine and detail the socio-psychological barriers to technology adoption. While CAT model was found to be useful artifact for Assistive Technology adoption, its little consideration to negative socio-psychological attributes necessitated minor additions, which are detailed by Sachdeva [14].

In this paper, the target population is totally blind people who are heavy users of assistive technology. A totally blind person often relies on assistive technology for better orientation, mobility [15], information gathering, social inclusion [13], and eventually, enhancing the quality of life [8]. In this context, a heavy user of assistive technology is a totally blind person who uses assistive technology for an average of over 6 hours every day.

The socio-psychological implications of blindness have been carefully studied by various researches [16], [17], [18]. However, co-relation between socio-psychological attributes and technology adoption for totally blind people has not been interpreted from a user-perspective. Through three interviews, this paper cross-examines behavioral attributes that impede assistive technology adoption. This research uses the proposed addition framework to the CAT model [14] as the base model.

The rest of this paper unfolds as follows: Section 2 highlights and explains the socio-psychological attributes that impede assistive technology adoption. Section 3 discusses the methodology used for this research. Section 4 shows finding from the interviews, shared as narratives surrounding the core constructs highlighted in Section 2. Where necessary, similarities and differences in findings are drawn. Section 5, the final section of this paper ends in conclusion and discussion, where emphasis has been maintained on discussing the possibilities of further research to understand this issue. The conclusion focuses on theoretical and practical contributions.

2 Background

2.1 Socio-Psychological Barriers to Assistive Technology Adoption

Assistive technology provides numerous benefits for people with disability. According to Hersh [13], assistive technology can be used to overcome the social, infrastructure and other barriers experienced by disabled people that prevent their full and equal participation in all aspects of society. Similarly, Carr, Gibson and Robinson [19] have pointed out that assistive technology allows people to continue in their normal roles and meet their expectations of life despite their physical impairment and disability. However, in the case of visually impaired and blind people, while assistive
technology is very useful, its implementation and accessibility has been often questioned [20].

Within this paper, special emphasis has been laid on assistive technology, focusing on the essential components of technological advances that can enable totally blind people to improve their quality of life. Some of the more common assistive technologies that are used by totally blind people include Screen readers [21], Braille printers [22], Personal digital assistants (both Braille and Speech operated) as well as audible tactile signs and warning surfaces.

The base framework highlights socio-psychological attributes that are likely to hinder assistive technology adoption for blind people. While the model extension is targeted towards totally blind people, its relevance to other disabled groups has not been tested, and detailed discussion on the topic is out of scope for this paper.

![Diagram](image)

**Fig. 1.** Model for socio-psychological barriers in assistive technology adoption for totally blind people [14].

The attributes in Fig. 1 are defined as follows:
- **Social Conditioning** is defined as the sociological process of training individuals in a society to respond in a manner generally approved by the society in general [23]. Due to the social paradigms surrounding blindness (as a disability), the unintentional negative social conditioning promotes a sense of positive discrimination, pity and sympathy for blind people. These factors can make (blind) people self-conscious, potentially hindering adoption of assistive technology.

- **Control over surroundings & Expectations**: While blind people wish to have control over their surroundings [24], [25], these wishes don’t always translate into reality, leading to frustration and anxiousness in assistive technology usage [26], [27]. Similarly, high expectations from assistive technology usage, followed by frustration or even failure could result in loss of trust towards technology, thus affecting assistive technology adoption.

- **Frustration and Anxiousness**: Quite often, one of the major reasons for lack of assistive technology is frustration from lack of understanding or ease of use. While personal characteristics (motivation to learn and use) can alter the level of frustration and anxiousness associated with assistive technology usage, people with no vision face certain difficulties with technologies that people without vision take for granted.

- **Social Embarrassment**: As highlighted in the study conducted by Shinohara and Tenenberg [27], (totally) blind people prefer to be aware of their surroundings in the way of knowing the time, location and other useful information. However, curiosity and unwanted attention from others, as well as lack of empathy, can lead to heightened self-attention [28], thus hindering assistive technology usage. Social embarrassment is also a major deterrent to assistive technology adoption for totally blind people.

A combination of these socio-psychological factors can hinder assistive technology adoption.

### 3 Method

#### 3.1 Research Question and Interview Design

The research questions that guided this study were as follows:

- Does a totally blind user heavily reliant on assistive technology resist adoption and usage of technology because of negative socio-psychological factors?
- What positive traits help totally blind people to overcome the hindrances introduced by negative socio-psychological attributes?
- To what levels are totally blind people are affected by social conditioning, expectations, frustration and anxiousness as well as social embarrassment when trying to use or using technology.

Given the limited understanding of socio-psychological barriers to assistive technology use in the case of blind people that are heavily reliant on assistive technology, it was considered that case-studies – specifically semi-structured interviews - would provide the best sources of information. Yin [29] suggests
reporting the case studies in the form of narratives, based on a clear conceptual framework. Stake [30] also supports narrative-based analysis as it optimizes the opportunity of the reader to gain an experiential understanding of the case. Based on this, a semi-structured questionnaire was designed for this interview. This questionnaire is presented in Appendix 1.

3.2 Participants

In order to understand the issue from varying perspectives, three participants were contacted and interviewed for this study. They were selected as a convenience sample [31], and the names used in the reporting are not real.

The first participant – John – is a high school student who has been blind since birth. Due to his young age, he had grown up in an environment which was conducive to assistive technology usage. He is heavily reliant on technology in order to carry out daily activities and spends over 60 hours every week using computers and mobile phones.

The second participant – Steve – is a mature student who is active in organizational activities related to welfare of people with visual impairment. His studies and active role in organizational activities necessitate heavy use of technology, and Steve often records over 45 hours of computer and mobile phone usage every week.

The third participant – Bill – is an online entrepreneur. His work involves spending over 65 hours every week networking and working online. Bill has been blind since the age of 36 (partially blind for a few years before that) and has previously worked with people with disability.

3.3 Data Collection and Analysis

This study used the theoretical framework in Figure 1 to create a semi-structured interview for participants. Based on the model, a list of 17 questions was constructed. These questions included basic fact-finding questions about personal life (name, age etc.), followed by well-directed, yet open questions discussing hindrance to assistive technology adoption.

For this study, each participant was separately interviewed through Skype. The interviews took between 25 to 90 minutes. During the interviews, the interviewer took notes actively, while the call was being automatically recorded. Along with the audio recordings, the hand-written notes provided a valuable point of reference for data analysis. The interviewer felt it necessary to discuss the premise of the interview with the participants before interviewing them, primarily because of the sensitive nature of the interview. When one focuses on the negative aspects of socio-psychological features that might be personal to the interviewees, it is in the best interest of everyone to discuss the premise and possible implications of the interview openly.

While it is impossible to predict outcome of the scenario where the premise was not discussed, the interviewer found that the opening up discussion before the actual interview allowed deeper discussion, and as a result, the interview responses were
thorough. Moreover, the interviewees showed no signs of inconvenience or feeling uncomfortable at any point. The responses, combined with pre-interview discussion provided some interesting observations, which will be discussed in the next section.

The interview analysis was carried out after the interviews, and focused on finding commonalities and differences in the interviewee responses. The data analysis attempted to explain the impact level of socio-psychological attributes that might hinder assistive technology adoption and use. The data was analyzed through inductive reasoning and was divided into the four socio-psychological attribute classifications:

- Social conditioning
- Expectations and control over surroundings
- Frustration and anxiousness
- Social embarrassment

The findings for this study were organized around the themes that emerged from the analysis. The narrative comments have been edited slightly for coherent readability.

4 Findings

4.1 Basic facts of the interviewees

Interviewing participants separately provided an opportunity to speak to them freely about how they are constrained in assistive technology use. As can be seen in Table 2, the three participants had varying age and professions; however, the similarities in their visual impairment provides useful base for analyzing their responses. This study focuses on the socio-psychological barriers that hinder assistive technology adoption in case of totally blind users heavily reliant on technology, and thus to stay relevant, only the responses directly related to this issue have been shared.

<table>
<thead>
<tr>
<th></th>
<th>John</th>
<th>Steve</th>
<th>Bill</th>
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<td>41</td>
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4.2 Social Conditioning

Those with developmental disabilities are pitied because it is often believed that people with disabilities feel unhappy, suffering, or are unable to live normal lives and meaningful lives [32]. In the research, Ntibea [32] found that the common social attitude toward people who were blind were pity and sympathy. This brings up a very important question:

*Would a totally blind person heavily reliant on assistive technology resist or reject further adoption or use assistive technology based on (negative) social conditioning?*

Negative social conditioning can be a detrimental factor for any group of people, regardless of their condition. In case of totally blind people, it is important to understand the role social conditioning plays in affecting assistive technology adoption and usage. Quite often modern technology in its most basic form is not accessible to totally blind people. Only after modifications (such as tactile surfaces) and enhancements (such as screen readers) can totally blind people use these devices comfortably. Based on this, participants were asked about their opinions on if modern devices were adjusted to the needs of sighted people, and if they had been on the receiving end of negative reactions regarding technology use from sighted people.

The responses, interestingly, differed across the interviewees:

*John* “Personally, it was easy for me to understand the logic of computers. I started when I was 10 year old. These days, I have stopped thinking about the logic…and regarding our use of technology – ignorance is expected, and it doesn’t bother me.”

*Steve* “Modern computer and mobile devices are made for ‘healthy young sighted-people’. Most developers are unable to consider needs of other groups…in some online chat rooms; people are surprised that I can use computers…Technical issues don’t make me frustrated, but they can be a problem sometime – when I cannot access information or my screen reader is too old for some net application”

*Bill* “The look and feel of iPhone is designed for the sighted world. But it works just fine for me…I don’t feel that I am marginalized…technology is adaptable, but lacks consistency.”

As can be seen, the look and feel of these devices did not faze the participants, though lack of consistency and minor oversights in design did cause problems. The participants generally anticipated ignorance regarding their use of assistive technology, and the comments to follow highlight the impact of this ignorance on their assistive technology usage:

*John* “Those who don’t know enough about technology wonder how I do what I do. This is something blind people encounter all the time, and not just with technology. People’s reaction (or ignorance) does not bother me…absolutely not…because the knowledge is not widely available.”
Recently, when I switched from conventional phone to a touch-screen phone, I started to do things differently. I became more self-conscious, because the things I did were not familiar to me. I found myself wondering “what were others thinking?” But, this made no difference in my technology use – I am simply more aware!”

[Steve] “The nurses were surprised when I was using SMS (texting). People think that we cannot use technology, and when they see us using it, they are surprised and shocked. There are exceptions, but few. This happens so often that it doesn’t bother me anymore.”

[Bill] “I am pretty knowledgeable…and people know my capability, so even sighted people come to me. And I am not conscious of using technology in public, which might very well be a coping strategy. I have to have a belief in myself!”

While the participants might have felt self-conscious in some instances, their feelings not affect their dependence and use of assistive technology. It can be argued that due to the high frequency of intrigue, the participants were de-sensitized and hence could continue living their daily life without any dramatic changes. As Bill pointed out, the de-sensitization could very well be a coping mechanism, thus allowing him to use assistive technology in public without feeling self-conscious.

Social conditioning can also have an effect on the personalities of the target population, thus affecting their attitude toward continued technology usage. In this case, it was inquired whether the participants preferred assistive technology or manual assistance (from other people) to carry out daily tasks. The responses were mixed, but gravitated towards preference for assistive technology.

[John] “I always prefer assistive technology, and don’t like asking for help unless I absolutely have to!”

Based on this data, it can be interpreted that social conditioning has not impacted heavily on the lives of John, Steve and Bill. Can the same be said for other blind users who are heavily reliant on assistive technology?

4.3 Expectations and Control over Surroundings

Expectation from technology is one of the major drivers of assistive technology adoption [33]. Berry [34] noticed that the perceptions of both beginner and expert blind-web users differed considerably. However, one theme central to both subgroups was the expectations from technology. Matching these expectations necessitates creating a sense of control over surroundings. Actions are determined by the need to achieve best possible results by controlling our surroundings, and this applies to totally blind people as well. Berry [34] also noticed that the two user groups performed differently when their expectations from technology were challenged – the beginner users would get frustrated and give up, whereas the expert users would try and navigate through the problems to find results. One of the aims of this study is to
ascertain whether Berry’s analysis would hold true for heavy adopters of assistive technology in this day and age.

How do totally blind users heavily reliant on assistive technology behave (towards assistive technology) when their expectations of assistive technology are challenged?

To start with, participants were asked about their expectations from assistive technology. The opinions on this were divided…while two participants were now realistic about expectations from technology; Bill was frustrated as the technology did not meet his expectations:

[Bill] “Absolutely, I expect more than it gives me. I am incredibly frustrated most of the time...The things that I do are very complicated. Technology does not simplify what I do, it makes life accessible. With technology, I can work; make money, and stand tall as an individual. But it does cause stress and frustration and constant learning curve.”

In case of blind users, high adoption and continued assistive technology usage could be promoted if the users felt positively about the technology. On the other hand, if the users felt neutral or negative towards the role of assistive technology, they would possibly resist adoption and continued usage. Interestingly, while John was realistic about his expectations from assistive technology, he was apprehensive of adopting new technology:

[John] “When I started, my expectations were high – computers were new to me. But as I used them more, my expectations grew more realistic. I am trying to live with how things are progressing. But still, I am more inclined to stay with my solutions. If there is something new, I might adopt it slowly, as I have no reasons to change my plans.”

This attitude highlights some resistance to new technology, which raises an important question – are blind people generally apprehensive of new technology? Could they fear adoption due to fear of steep learning curve? It would seem that blind people do find it difficult to switch to new technologies, but when the technology works, like in the case of Bill and iPhone, the transition to a better assistive technology is welcomed!

Interestingly, trust plays a major role in technology adoption and acceptance [35-36], and since assistive technology adoption is based on the same fundamentals, the logic of trust can be extrapolated. Lack of trust towards technology can hinder assistive technology usage even for the more regular users. When asked whether the participants trusted the technology they used, the responses highlighted an interesting trend – Technology can be trusted, but with a small caveat – as long as the processes are followed, technology will fulfill its function. However, in case this trust was to be challenged, the participants had different reactions. Interestingly, one of the participants did not even consider trust to be an issue:

[Bill] “I don’t have any choice, do I? Generally, I avoid sites that could affect my computer (by giving it viruses), and I don’t even use torrents and other game sites...if someone is going to rip me off, they will rip me off anyway...can’t do anything about it!”

[John] “With things that could go wrong, and when there is a risk – I am quite self conscious and try to be more aware of what I am doing. Still, I don’t ask for help.”
While these users have a realistic of expectations from assistive technology, even failure in certain circumstances has not dented their assistive technology adoption. This can be explained due to participants’ high level of experience with technology, as well as the lack of other options that could help them solve problems independently. Interestingly, throughout the interview, Bill gave some conflicting answers in terms of his trust towards technology, with the following excerpt that sums up his dilemma:

[Bill] “If I want to save data for future use, I can do it on a notepad (in computer), but then there are data theft risks. What if someone gets into my computer?”

While Bill had previously said that he does trust technology, his most recent statement highlight possibilities of data theft and misuse. The conflicting nature of these statements is difficult to explain, but it can be argued that since Bill knows about potential pitfalls about technology, which simply makes him more aware, and not apprehensive of technology.

### 4.4 Frustration and Anxiousness

Lack of trust in technology, failure when expectations are high and negative social conditioning - all these factors (and more) can lead to frustration and anxiousness. Coupled with that, personal attributes such as lack of patience or understanding, as well as lack of commitment that limits time spent on using assistive technology can affect assistive technology use. As part of this study, one important question that needed practical consideration is:  

*Do frustration and anxiousness affect totally blind users who regularly use assistive technology? Does this frustration effect hinder assistive technology adoption and use, and if so, how?*

Interestingly, the discussion surrounding frustration and anxiousness had inadvertently come up when talking about other issues within this interview. The results were almost always synchronous – all participants had faced frustration and anxiousness when using, or trying to use assistive technology. Some participants had faced frustration from failure of technology, and some had faced frustration and anxiousness from lack of availability and accessibility, which in part can be blamed on the context and environment in which these participants operated. Generally, when inquired about their frustrations when using assistive technology, participants were forthright with instances where they had faced issues which were beyond their control:

[John] “Occasionally I get frustrated with technology; I guess every blind person does. Even though assistive technology has progressed in recent years, there are still some applications that I can’t use! It’s a frustration because I would really need these programs and applications. Things are simpler with mobile phones. On some occasions, the battery on my laptop died when I was in school…as I didn’t have the power cable. And I was stuck as all my notes and books were in there. These instances often occur more at school than at home.”
“When I need a website but it is not accessible, I get frustrated. Like sometimes, when a program or application is updated, and I cannot access it anymore, as it is not compatible with my screen reader...especially if I have not been informed before.

When technology fails, I prefer assistance from others. ‘Computers and helping aids are there to help, and not a project in themselves.’ I don’t take up any new technology unless something needs changing. I only change computers when needed. Moreover, I try and improve the system only if I have time and interest.”

“Lack of consistency in technology causes me numerous problems. Something as simple as chip and pin machines that accept debit cards should be standardized. I have to learn different layouts of same technology. I am frustrated by the fact that I don’t have people around me, which would help me in doing things that are outside my (and technology) control. For example, I recently lost my debit card, and now I have a new one. They have sent my pin number through, and of course, I cannot see it. And because of the way the number is printed, I cannot use a scanner to read it either. It is impossible!

...I have been incredibly frustrated most of the time with technology. Recently, JAWS keeps hanging, and my new laptop is slow as well. What I do online is very complicated...and to use access technologies for that is even more complicated. Technology has a constant learning curve...and price for all this is frustration, stress.”

Multiple instances of frustration and anxiousness related to assistive technology use highlight complexities in user-behavior towards (assistive) technology. While all participants are continually challenged by lack of consistency, availability and accessibility in assistive technology, they continue to rely on it for their daily living. In certain cases, frustration and anxiousness has given rise to resourcefulness. On multiple occasions, John emphasized:

“But still, I am not stuck; I try and find other (technical) solutions independently.”

4.5 Social Embarrassment

Embarrassment avoidance drives people to avoid situations or scenarios which might be awkward or uncomfortable [37]. When people feel socially embarrassed, they are more likely to resist or reject technology usage [38-39]. Similar inferences can be drawn in the case of totally blind people. It is pertinent to study social embarrassment in relation to assistive technology adoption as this could improve assistive technology adoption. However, the level to which heavy users of assistive technology (in this context – totally blind people) face social embarrassment is yet unknown; which leads to the question:

Do totally blind people heavily reliant on assistive technology feel social embarrassment due to their condition, and does this embarrassment hinder their dependence on assistive technology?
Imagine a scenario where one has been told off for using their mobile phone in public, as the noise from the text-speech disturbs others. The text to speech synthesis functionality of assistive mobile devices could be considered disruptive in public. A few too many instances of being cautioned could hinder further use of these devices in public, thus impeding assistive technology adoption and use. A major possibility of social embarrassment is feeling guilty when seeking help from others, or relying on others for assistance. Interestingly, none of the participants felt guilt or awkwardness when seeking assistance from others. Their perception on seeking outside help was positive, but in one particular case, the participant found absence of assistance frustrating.

[Steve] “I was supposed to go shopping today with my assistant, but now I cannot as he is ill. Now, I am not sure when I can go to the shops next, and it is frustrating as I can’t do it myself. But that’s life! I will have to wait to fix a schedule.”

It does raise an important question about whether basic needs for blind people can be catered for using technology. As it turns out, they can, and Bill commented that he relied on online shopping to order food to his home. The participants also mentioned that they hardly felt uncomfortable using assistive technology in public. If anything, curiosity from others was well received, as it allowed the blind users to showcase assistive technology to people who knew nothing about it:

[John] “I really like to explain things, and if people are genuinely curious in things that I do—they are not limiting themselves. If people are curious, I am more than glad to explain what I am doing. But sometimes, when they are curious and pointing fingers, I don’t like it.”

[Steve] “When you get the unexpected attention, you get a chance to share some important information with others. I was able to explain to doctors and nurses (who were previously unaware) that blind people can indeed use computers. Then they can share information with their colleagues. It helps spreading awareness.”

Based on the participant responses, it can be inferred that social embarrassment does not play a strong role in directly hindering assistive technology adoption and use. The participants are heavy users of assistive technology, and based on their responses, it seems likely that they turn around the negative scenarios by creating more awareness about assistive technology and blindness.

5 Discussion and Research Implications

Assistive technology has provided totally blind people an opportunity to improve their quality of life. Throughout the interview phase, it was realized that for some people, assistive technology is the sole means of independent living – whether through choice or otherwise. But technology use and socio-psychological attributes are inter-related. This research was carried out to highlight the impact of negative socio-psychological attributes on the lives of totally blind people that were heavily reliant on assistive technology. Interestingly, all participants showed some frustration regarding assistive technology use, which was borne out of inconsistencies in technology application and
lack of accessibility. These participants had faced multiple instances of frustration, but their attitude highlighted resilience and resourcefulness in dealing with these frustrations. Regardless of the frustrations and anxiousness, these users continued to rely on assistive technology for daily living.

The perception surrounding technology was that it was built for ‘healthy young sighted people’. This perception was backed by the idea that these technologies had minor oversights, which affected usage for totally blind people. While the participants didn’t highlight any extreme cases of negative social conditioning, it was evident that as blind people, they received a lot of interest from sighted people who were unaware of their abilities to use technology. In most cases, the participants used these situations to educate and spread awareness about assistive technologies. Moreover, social embarrassment was never highlighted to be an issue when using or wanting to use technology.

Positive expectation of assistive technology is a strong factor in increasing adoption and continued use. While the participants tried to be realistic in their outlook towards assistive technology, they highlighted certain lack of control over their daily life which was in part related to lack of accessibility and failure of technology. As a result, the participants showed resistance to anything new, until it was very necessary. This behavior certainly limits assistive technology adoption, and should be investigated further in order to find out if its effects could be mitigated through training, even in the case of heavy users of assistive technology.

One thing that particularly stood out in this research was the resilience and resourcefulness showcased by the participants. Whenever the participants were challenged by technology, or struggled in reaching their outcomes, they tried other means. One of the obvious choices was to resolve issues using assistive technology in a different way, and John, in particular, tried all things possible to avoid asking for help. This need and struggle for independence increases reliance on assistive technology. However, the other participants were also willing to try different solutions before seeking help from other individuals.

While this research is not an exhaustive representation of all totally blind population, it highlights interesting similarities and differences in heavy users of assistive technology. This research delved further into socio-psychological attributes pertaining to technology usage for totally blind people. The interviews allowed a better understanding of how (perceived) negative socio-psychological attributes impact on assistive technology adoption. This research could further benefit from case studies that look at low and medium-intensity blind users in order to better understand their attitudes towards assistive technology. From a practical perspective, this research offers opportunities to better train and help heavy users of assistive technology to balance their expectations with the technology available. This research also provides enough justification for developers to work on creating an ‘equal’ technology for everyone.

References


**Appendix 1**

Interview Questions (Semi-structured)

1. Could you please state your name, age and occupation?
2. Could you please tell something about your condition…how long have you been blind?
3. How often do you use computer and mobile phone?
4. Depending on the answer to Q3…
Please explain why you use these devices, and tell me how they are useful to you.  Please explain reasons for not using these devices. Do you feel you would like to use them more often, and if so, what is stopping you right now?

| Social Conditioning | 5. How do you feel about the fact that modern devices including computer and mobile phones are adjusted to the needs of normal sighted people? |
|                     | 6. How do you feel when other people consider you less capable of using computer and mobile phones? |
|                     | 7. Do you feel self-conscious when trying to use these devices? |
|                     | 8. For accomplishing most things in your daily life, do you prefer to rely on other people or assistive technology? Would you be more likely to adopt technology if there were less people to assist you? |

| Control over Surroundings and Expectations | 9. Do you have high expectations from computer and mobile phone usage? If yes, what kind of expectations do you have? |
|                                            | 10. Do you expect computer and mobile phones to simplify your life? |
|                                            | 11. Do you trust the technology you use (for example, internet banking, and text messages)? If no, why not? |

| Frustration and Anxiousness | 12. Do you feel any kind of frustration or anxiousness when you use computers and mobile phones? |
|                            | 13. What happens when these technologies fail to help you? Do you look for alternate technology solutions or do you seek assistance from other individuals? |

| Social Embarrassment | 14. Is it easy to navigate through TV channels or does someone else help you with it? How does that make you feel? |
|                     | 15. If other people assist you, do you feel bad about being dependent on them? |
|                     | 16. Does curiosity and unwanted attention from people hinder you from comfortably using technology? |
|                     | 17. Does it bother you to use your phone in public? |
Recognizing and accommodating multiple rationalities in patient oriented health information system design

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Abstract. Informed by an action research study conducted within the context of a Ugandan mother and child health programme, this paper identifies three different rationalities pertaining to the phenomenon of patient tracking; i) personal choice; ii) clinical tracking; iii) and public health management tracking. The identification of these three broad categories of rationalities emerged from our study of existing work practices utilizing paper-based information artifacts for following up pregnant women. The study further investigates how these different rationalities has informed the design process of a new electronic web and mobile phone based information tool that covers multiple contexts of use and accommodates multiple coexisting rationalities. The resulting information system combines point-of-care data utilization, post-visit data management and aggregate data reporting. The tool merges a data warehouse approach based on structured patient data with flexible tools for unstructured notes and comments assisting face-to-face clinical consultations.

Keywords: health management information system, eHealth, patient tracking, continuity of care, rationality, information system design.

Introduction

Information systems supporting health service follow-up activities for individual patients are inherently complex and difficult to design, especially when they are required to accommodate a multiplicity of user roles and needs. These systems may need to accommodate the migration and referral of individuals across health care units; bridge private and public sector interests; and negotiate ownership, security and privacy concerns related to patient health data. A patient oriented information system’s functional scope can range from supporting the work of one nearly isolated private practitioner in a rural community clinic, to facilitating information flow and enable comprehensive health care across hospital wards, health care units, and programmes within and across large regional or national health systems.

In the case of pregnancy follow-up, direct users of historical patient information can include the pregnant woman herself, nurses, midwives, general practitioners and highly specialized physicians dealing with referral cases. In addition, the patient oriented information system may be drawn on to share information with billing, logistics and human resource systems, aggregate data for public health management and health
insurance information systems, to name a few. Different contexts and needs impose new and sometimes contradictory information system requirements. Understanding the underlying rationalities of heterogeneous information users at various stages of patient follow-up and related activities is thus important in guiding the design process of such information systems (Robey and Boudreau, 1999). The paper focuses on how different logical foundations, or rationalities, play out in informing the design of a new electronic integrated patient oriented information system.

**Tracking patients throughout health programs**

Since the WHO conference culminating in the Alma Ata declaration in 1978, many countries have emphasized primary health care as a key strategy towards “health for all”. Broadly, the aim has been to improve the overall public compliance with national health programs, facilitated by a move towards more preventive rather than curative health services (WHO 1994; Kimaro and Sahay 2007; Braa et al. 2004; Lehman et al. 2007). A health program consists of a number of more or less formalized encounters between the individual, hereafter referred to as the person, and the health system, during which the person receives some form of preventive or curative health care service.

For the purpose of this paper, we define the concept of health program tracking (just tracking for short) as the process of following up a person receiving health services, including the responsibility for guiding them through a health program, collecting and acting on relevant individualized health data throughout this program as well as following up on related routines and activities. An information system supporting these functions is by this definition a tracking information system. Thus, tracking is for instance used to achieve comprehensive quality health services and continuity of care - a term widely used in the primary health service (Haggerty et al. 2003), while it could equally well be used to manage social security schemes targeting persons eligible for refunds on personal health expenditures.

The role of following up persons and administering their adherence to health programmes in low-income countries is often handled by community health workers (CHW) situated in their home villages. (Lehmann and Sanders 2007; Schneider et al. 2008; Hlophe 2006). Projects involving health workers at the periphery of the health system have successfully leveraged mobile technology to help program tracking and improve the communication between CHWs and health clinics (Ngabo et al 2012). For instance, such systems can be used to send an SMS to health workers with lists of women who have missed appointments (MacLeod et al 2012). Sending such reminders to the health workers managers, if necessary, has been demonstrated to improve the follow-up of patients (Derenzi 2012). However, for the mobile phone to be a powerful tool for health workers, the recipients must be acquainted with the intentions, purpose and rationale of the message, or these reminders will simply be ignored (Chib et al.
The health services in many countries use paper based registry books to log patient visits, providing a basis for health management information systems. These registry books are typically not well suited for reviewing the progression of an individual person throughout a health program (Chi et al. 2011; Garrib et al. 2008). As a complement to the registry books, many countries let persons carry their own individualized health information on paper between visits (Turner and Fuller 2011; World Health Organization 1994). For successful adoption of an electronic tracking system, the information system and tools made available have to be an improvement over the systems that are already in place and fit the rationalities that practitioners base their work flow on (Ngoma et al. 2012; Berg 1997).

The challenge of accommodating multiple rationalities in patient tracking information systems

The research question of this paper is: Which multiple rationalities are dominant amongst users of a person tracking information system and what are the design principles emerging from these rationalities?

Implementing a health information system is challenging when the system spans multiple institutions, multiple programs and technologies with diverging logics and ways of reasoning (Sanner et al 2012; Currie and Guah; 2007; MacLeod et al 2012; Heeks 2006; Braa & Sahay 2012; Lehmann and Sanders 2007). Firmly grounding information system design in either one rationality can lead to tensions and conflicts if the information is to be shared across programmes and disciplines or utilized across information systems whose design is based on diverging or conflicting rationalities (Chilundo & Aanestad, 2004).

The research covers the use of person tracking information systems in low-resource settings, but our concern and method for the appropriate design of tracking information systems may also be relevant in developed countries where the service burden of elderly people who require follow-up from the health service is increasing dramatically.

This paper draws on an empirical study following the efforts of making an integrated program of antenatal care, delivery and postnatal care in Uganda, with particular focus on preventing mother to child transmission of HIV (PMTCT). The study illustrates how some health workers are concerned about being able to follow up the person through tracking information systems, as defined above, while others - for valid reasons - leave the responsibility to the person herself. Furthermore, amongst those who consider person tracking important, there are multiple coexisting rationalities legitimizing the claim. Investigating these rationalities have led to an iterative emergence of design principles that have been inscribed into the ensemble artifact during the research process.
The remainder of the paper is structured as follows: first we review relevant literature on multiplicity in rationalities informing information system design and other useful theoretical concepts; secondly, the research background, methodology and context is described; then the empirical material and our research findings are presented; followed by a discussion highlighting how the different rationalities of public health management and clinical point of care relate to each other and shape the design of person tracking information systems.

Theory and conceptual framework

In their policy and practice oriented work on health information system strengthening and restructuring Lippeveld and Sapirie suggest, quoting Reinke, that an essential question for health information system designers is how “to add rationality while still accommodating the interests of diverse constituencies and value systems” (Reinke, 1988, in Lippeveld & Sapiere 2000). This concern is close to the rationality-design issues which are the focus of this paper. However, our theoretical approach is informed by a broad-ranging concept of rationality based on Max Weber’s work (Kalberg, 1980; Weber 1978). This broader notion of rationality encompasses and acknowledges multiple constituencies and value systems, rather than distinguishing rationality from them. A key concern with health information system design, we would argue, is to recognize and accommodate a multiplicity of coexisting rationalities.

Recognizing Multiple Rationalities

Fundamentally, the idea of rationality offers explanatory power and understanding of how and why people arrive at decisions to act and behave in certain ways. Max Weber, in his critique of neoclassical works’ limited exploration of rationality, distinguishes between several types of rationality; formal, substantive, theoretical and practical (Kalberg 1980). Of these, substantive rationality for example is based on values rather than a simple means-end calculation. Values are not necessarily demonstrable or justified through scientific methods, but may still provide the basis for a consistent rationality towards a substantive end goal.

It is not the purpose of this paper to classify rationalities according to Weber’s types of rationalities, nor discuss his work on rationalization. Rather, we want to highlight that Weber’s distinctions represents a radical perspectivism in that there can be multiple rationalities each based on different rational perspectives. “Something is not of itself irrational, but rather becomes so when examined from a specific rational standpoint” (Weber, 1930 translated by Kalberg, 1980). Drawing on this framework an analytical observer would typically identify multiple rationalities within a social group. These rationalities may be based on different logical assumptions, but still be considered rational (McNeill 1978; Karpik 1972; in Bryman 1984). Similarly, what seems irrational at one level may appear perfectly rational at another level of analysis (Bryman,
Rationalities can also be constructed after the fact as a process of justifying or giving meaning to the outcome of an otherwise seemingly random sequence of events, decisions and actions. A single individual may draw on multiple rationalities, to explain or justify a single action or event, even seemingly contradictory ones. Finally, as Habermas shows us, rationalities may be negotiated to arrive at a consensus (Habermas 1984, 1987).

Within the context of health care and health information systems research Heeks et al. (1999 and 2006) identify and explore what the authors refer to as three archetypes of rationality: technical, managerial, and medical. The technical rationality describes information system artifacts as objective and neutral, with a lack of appreciation of political or cultural values. Managerial rationality is depicted as concerning stakeholders’ interests and money, both of which are considered to be objective. Medical rationality focuses on the disease-specific information transmitted through the information system. Clearly, these three rationalities inform different health information system design decisions, but they do not recognize some of the - in Heeks’ words - “softer” rationalities, such as “health for all” and patient centered care, which would be what Weber considers substantive or value informed rationalities. Hard technical, managerial or medical rationalities may prevent genuine differences in interests and values from surfacing as political issues, by re-framing them as technical problems to be resolved by professionals (Scott 1998).

Mol (2008) contrasts the “logic of choice” with the “logic of care”, indicating that when you give a person the option to choose between health treatments, this flexibility may contradict with providing the best care. In a similar way, tracking a patient through a health program may conflict with the person’s ability to choose their own health treatment.

In a comprehensive study of IS in healthcare, Currie and Guah (2007) describe how conflicting logics in the UK health system have been both drivers and inhibitors of change in the design process, with special focus on the trend for patient choice.

**Inscribing rationalities in Information Systems**

As noted earlier, the concept of rationalities seeks to explain how and why people arrive at decisions to act and behave in certain ways. Technology *inscription* refers to the way technical artifacts, like information systems, embody patterns of use. Inscription could therefore be seen as the process of designing certain rationalities into an information system. During the information system design process, the developer works out a scenario for how the system will be used (Ciborra 2002). This scenario is then inscribed into the technical artifact (Akrich 1992). The inscription includes *programmes of action* for the users to follow (Latour 1992 page 255; Akrich 1992), and defines roles to be played by users and the information system.
In situations where the inscribed programme of action does not fit with the actual practice of the user, useful workarounds may be deduced, but only to the extent that the information system is flexible enough to allow for reinterpretations by users competent enough to leverage its interpretive flexibility - “the capacity of a specific technology to sustain divergent opinions” (Sahay & Robey, 1996, p. 260). The space for users to deduce new programmes of action is thus limited by the interpretive flexibility of the information system - information technology conglomerate.

Research methods

Action design research

Action Design Research is a research method that integrates Design Research (DR) and Action Research (AR), to create a method which focuses on the development of a theory-ingrained, innovative ensemble artifact (Sein et al. 2011). An ensemble artifact is one whose scope includes the social processes surrounding the artifact rather than just the physical software (Orlikowski and Iacono 2001). Sein et al (2011) conclude that the contributions from an ADR project should be in the form of design principles, that these principles should address a class of problems and that the outcomes should be innovative.

Gregor (2006) splits IS theory into 5 main areas: analysis; explanation; prediction; explanation and prediction; design and action. Sein et al (2011) state that Action Design Research could fit the two last types of IS theories. The first of these focuses on explaining a phenomenon, providing causal explanations and testable propositions. The last focuses on describing how to implement an artifact. A design principle that describes how to design and implement an artifact falls under this group, though the definition of a design principle varies in literature from a universal testable truth to more of a guiding principle (Braa et al 2004). According to Sein et al (2011) and Gregor (2006), such design principles are also theoretical contributions if they relate to a class of systems. The design principles of artifact ensembles are however not as testable and generic as those one may find in a repeatable lab setting, though they may be more applicable when embedded into a social setting (Sein et al 2011). The design principles discussed in this paper are more like design templates than the harder design principles as described in some design research approaches (Markus et al. 2002; Walls et al. 1992; Hevner et al. 2004).

Research design

This paper is the result of an action research project using the Action Design Research method (Sein et al 2011; Baskerville and Myers 2004; Baskerville 1999; Braa and Vidgen 1999; Vidgen and Braa 1997), implementing a class of systems which tracks mothers and children in low resource contexts. The design and implementation has evolved through several cycles of development involving an increasing number of
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practitioners and users. The project is supported by the Ugandan Ministry of Health and is headed by the MU-JHU institute. Several of the authors are part of a global action research program called HISP (Braa et al. 2004; Braa and Hedberg 2002; Sahay et al. 2009), which develops and deploys instances of an open source and web based Health Management Information System platform called DHIS2 and its mobile extension DHIS-Mobile in many countries.

Two of the authors live and work in Uganda, and are involved in medical research and interventions as well as implementation of health information systems at national and local levels, in close cooperation with the ministry of health. The first author, a Norwegian national, performed four field visits to Uganda within one year, visiting hospitals, health clinics, program implementers’ offices, training sites, ministry of health facilities and the US Embassy. By being close to the design and implementation action this study is informed by access to various stakeholders’ diverging and sometimes conflicting responses and interpretations of agendas and events pertaining to the status quo as well as one IS innovation in health care in Uganda. The ambition of our analysis is to understand what is happening in this particular situation, where multiple rationalities become visible through an IS design process. We recognize that there is not one correct perspective informing IS design, including the design decisions we have arrived at ourselves through engaged action research and analysis. Rather, we find it necessary to explicate the information system design decisions that are taken for granted from the perspective of different rationalities. In doing so our ambition is to move closer to a Health information system designs based on shared understandings and strengthen the appropriateness and usefulness of the IS innovation.

Data collection

We visited and interviewed health staff at three health facilities near the capital city of Uganda and two health facilities in a rural setting. The rural facilities are part of a strategic program for following up mothers and children, and we expected these to have working tracking processes and better communication between health facilities and community health workers. The rural facilities would therefore provide a benchmark of what could be achieved if sufficient attention was given to continuity of care. In the rural area, the main visit site was chosen by program officials, but another site was visited without their prior knowledge. In the urban area, the visit sites were selected by one of the authors based on her knowledge of the facilities.

The data collection for this research was a mix of observations during more than 20 encounters including project meetings within the team; semi- and unstructured interviews with health staff, community health workers and program officials working on tracking mothers; and observations from training and demonstrations of the software. Some interviews were performed in groups with several health staff and researchers present, similar to ad-hoc focus groups, while some interviews were done between a
single researcher and individual informants. Community health workers were interviewed with program and health staff present. The authors were introduced before the interviews as researchers and developers of the person tracking system. Interview data collection was supported by detailed note taking, audio recording and video-taping of training sessions. Policy documents and other official documents from the ministry of health in Uganda were also studied.

**Software development**

The action research project is based on the deployment and further development of a health information tracking system based on the open source DHIS2 platform. DHIS2 as an aggregate HMIS platform is deployed in more than 20 countries, and the DHIS tracker module has been tested and deployed in India, Tanzania, Vietnam and Malawi. The project required substantial changes in the software before deployment in the Ugandan context. The initial scope of the project was to implement a pilot where a low number of facilities introduced the DHIS tracker tool for improving the existing tracking process as well as sharing tracking data across multiple facilities. The pilot is currently being rolled out, and this research paper is based on observations during the preparations and design of the pilot.

In addition to project meetings and training sessions, the project conducted simulated data-entry sessions involving the authors as patients and the actual health staff doing the data entry, to guide the design of the software. After each session, feature requirements were documented and our developers in Vietnam implemented most of these requests for the next day’s workshops and training. During each field visit, the software hence went through many short cycles of development and testing as the design principles surfaced and were inscribed into the software.

**Data analysis**

Notes and observations were summarized and shared after the interviews, and concepts were discussed in project meetings. The authors later refined the identified concepts through the use of data displays and in-depth theoretical analysis (Miles and Huberman 1994).

As part of the global HISP research and development process, findings and observations are also shared and discussed across groups working with the development and implementation of the free and open source software globally. The particular software tool being developed is used in several countries, and workshops are held regularly to coordinate development and help inform the global deployments with emerging requirements from the local contexts. Discussions from these workshops as well as discussions with practitioners in other countries have helped form the analysis in this paper.
During this study, we have focused on *following the data*, looking at how health data is noted, stored and used, assuming that the handling and transferability of content also indicates to us the underlying rationalities that are inscribed into the existing tools. Studying the existing paper based tools has therefore been an essential part of the data collection and has informed our use of the concepts of the multiple rationalities.

**The case of tracking information systems for mother and child health in Uganda**

In Uganda, the health care during pregnancy and follow-up of the mother and child has traditionally been split into separate parts focused around antenatal care, delivery, postnatal care and immunization of the child respectively. This paper looks at an information system designed for a more integrated approach, driven by a general wish expressed by the Ministry of Health in Uganda and development partners to improve maternal and child health as well as a special focus on prevention of mother to child transmission of HIV.

**The different levels in the health service**

The health system in Uganda is split into different levels, with requirements for staff qualifications and services; District Health Office, District Hospital, Health Center 4 (HC IV), HCIII, HCII and Municipal Council. The HCII and HCIII have midwives and nurses, but do not have doctors and operating theatres, so critical patients are referred to HCIV or District Hospitals. In addition to the formal health service staff, some districts have community health workers that form part of a voluntary Village Health Team, each team often managed by a mix of implementation partners running one or more programs. Each VHT worker should help provide care to around 35 households, but in practice this number may be as high as 180 households.

**Following the mother and child through the health program**

An integrated program for mother and child typically include four antenatal care (ANC) visits, the delivery itself, and postpartum visits. The program can be adjusted to reflect the mother having HIV or some other condition, making more visits necessary and also involving more health workers at different locations. Integrating these programs and staff with a single information system is difficult because it requires a great deal of flexibility to combine the individual clinical conditions of the patients, coupled with an intention to maintain a rigid program that can be monitored by program administrators. The system also needs to accommodate health workers who have very different focus throughout the cycle of ANC, delivery and post-delivery. During the integration project there was considerable discussion about the number of necessary encounters between the patient and the health services and the data to be collected at each encounter. Fig. 1 shows an abstraction of some of the most important events in the integrated ANC...
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program. The figure is based largely on requirements and guidance from the Ministry of Health in Uganda.

An HIV infected mother should attend more visits, and depending on other clinical requirements in the pregnancy, the pregnant woman may also require different sets of follow-up visits.

Fig. 1. shows some of the stages and possible exceptions in the integrated treatment of the pregnant woman, delivery and follow up after birth of the mother and child. It also shows where the patient data is stored, and how mother health passport is the main artifact for distributing and sharing information across the stages.

Transferring and tracking patients across health units

There are Ministry of Health (MoH) guidelines to generate a serial number for each new pregnant woman at a health clinic, but the assignment is internal to each clinic. Each facility have their own numbering, such that mother number 100 at one facility would be a different person from 100 at another. This number is used in the registry, in the hospital journal if there is one and in the mother passport. In Uganda there is not yet an operational national identity number scheme, which would have provided unique patient identifiers for the tracking information system and improved the actual patient tracking across health service providers significantly.

Pregnant women migrate between different health clinics either as part of a formal referral process or based on their own preferences. We were told that pregnant women may choose to deliver at another health clinic simply because their regular health clinic has a bad road or is difficult to get to at night. Not all services were available at all sites, and the larger hospitals naturally handle more of the difficult cases, but also provide
basic services that could have been provided at smaller health facilities. Migration of pregnant women is normal and accepted by the mothers themselves and health workers.

At one facility where this study was being conducted the health staff explained that they would sometimes pay for transportation out of their own personal funds to transfer laboring women in very critical conditions to a larger hospital. In part, it was argued, this was done to avoid the paperwork and inspections following maternal deaths at their facility. On the other hand, the over-crowded larger hospital has ambulances ready to transfer non-critical patients in labor to smaller facilities if these could deliver elsewhere.

**Institutionalized patient tracking artifacts**

Historically patient data concerning the ANC program has been recorded and physically kept in several places using multiple tracking artifacts; mother health passport or health card, registry books and patient journals. A mother health passport is brought by the mother to visits at the clinics and contains her most important medical information. The clinics also record data into registry books for aggregate HMIS reporting purposes. There are separate registry books for ANC, delivery and after-birth visits, used at different wards and departments in the clinics. In addition, some hospitals keep local paper-based journal systems where they store patient-related historical data across visits as shown in *Fig. 2*.

**Fig. 2.** Depicts a single patient journal and the filing cabinet at the hospital where the patient journals are kept. The journals are filed according to patient number, and it is difficult to find the right journal without knowing the corresponding number.

**Mother health passport**

In Uganda, the health data is literally in the hands of the mother, as she brings a paper booklet called the “Mother’s health passport” to each health visit (see *Fig. 3*). The passports can be used to track up to four pregnancies, and are actively used at health facilities. The predecessors of the health passports are simpler and less comprehensive
health cards. In practice, these cards are still frequently used instead of the newly designed, more expensive and elaborate health passport consisting of 48 pages. At hospitals that have paper based journal systems, the health passports and health cards are often not used, because the data is kept at the hospital.

![Mother Health Passport](image)

**Fig. 3.** shows page 4 and page 5 of the Mother health passport, representing the same information as one side of the antenatal health card. The passport allows for the data capture of four pregnancies.

Medical information and the date for the next appointment is hand written into the passport during each visit by the health workers, and it is brought by the patient to subsequent appointments. During the visit, the patient may move physically between the service stations of different health workers and the passport is an important artifact for passing information even within the health facility. The information system relies on the data staying with the patient, so the health worker does not have access to the data unless the patient is able to physically bring the Mother health passport for consultations.
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Fig. 4. illustrates how the mother passport is used to enter data. Some large facilities store health data locally in a client form (journal) which is patient specific and spans multiple visits. All facilities store data in designated registry books.

One midwife explained the practice: “Whenever they come to ANC, they have to come with them [the health card]. Because the first thing we ask them is for the card, and it’s first come first served. … [If she didn’t bring her card] she would have to come back another day. We cannot go back in the [registry] books for all those people.”

The health passport is normally brought to every appointment, but there are times when the mother loses or forgets the booklet or does not bring it intentionally. For example, the woman may not bring her passport if she would like to keep her husband unaware of the visit. Upon arrival at the health facility she would then say that she lost her passport and may get a new empty one.

In addition to mothers carrying their health passports, health clinics have been provided with a schedule appointment book to write down the next appointments so they can plan and potentially see which mothers do not show up for their appointments. However, this book did not appear to be used as a general tool at the semi-urban facilities visited by the researchers. One midwife stated that it represented too much work to use it. Two facilities in a high-resource rural area were using the schedule appointment book, and they used community health workers to remind patients. Thus the perception about who is responsible for continuity of care - the patient or the health care providers - varies.

Registry books
The health registry books are physically heavy and wide with one long line of data elements to be entered per visit. The data is registered chronologically as patients enter
the clinic. Subsequent visits by the same patient are thus logged later in the book. Apart from indicating the programme stage of the present visit by drawing a circle around a number between one and four (see Fig. 5), there are no other references to previous visits encapsulated by a registry book entry. The locally provided id number and personal details provide the identification data.

There is one of each registry book per clinic, and it is located at a single desk rather than being passed around, following the patient. In clinics where antenatal care, delivery and postnatal care are split, the three different registry books are placed at each respective registry desk within the health clinic. While the registry books support the health management information system reporting well, they are not appropriate for following up the longitudinal health status of each mother. One health worker described this as “Paper is difficult to analyze backwards”. Another one said “We cannot go back in the books for all those people”.

There are separate registry books for antenatal care, delivery and postnatal care, and the main function of the registry books is to collect health data for the monthly MoH reporting. Health data such as the number of ANC 1st visit and deliveries this month are counted using the registry book and entered into paper forms. Uganda has an electronic HMIS system in place and all districts use Internet connected computers to enter the aggregated data into the central data warehouse.

A recent pilot study in Uganda has tested the feasibility of using longitudinal registry books, logging all visits for antenatal care, delivery and postnatal care on a single line, thus maintaining the tracking function within the registry book. The longitudinal registry book collects the most critical information throughout the program in one place. The longitudinal registry was piloted in a number of districts, but it has been discontinued because it could not be applied across all envisioned settings. It worked well in small health units where all services were coordinated through one “desk”. In other settings it required the physical transportation of the book within the health facility or health workers had to walk to a designated book location to update it whenever there was an event to record. The longitudinal registry book was therefore not used for data capturing during actual service provision, but rather filled in afterwards.
New electronic person tracking system

The project adapted and further developed the person tracking module of DHIS2. This open source tracking software was used in India, Tanzania, Malawi and Vietnam prior to and during this project, and was inscribed with design features covering those context. DHIS2 is used as a national system in Uganda for routine aggregate reporting, but not yet for patient-based data. Prior to the project there was an understanding that several modifications would have to be made to adapt to this project, but that these changes would make DHIS2 more usable in many other similar projects, including Tanzania. All of these deployments use the same source code and developers, and during the project there were several occasions when requirements from the different contexts contradicted each other. In one example, a new tracking screen was added for the Uganda project, but was picked up by another country and adapted to their context, loosing important requirements from Uganda. The screen was changed back, but the menu item of the screen was changed to ‘Lost to followup’ to indicate more clearly which use case the screen was meant for, and the underlying rationality of the use case.

Lost-to-followup screen

The earlier version of DHIS Tracker in India was based on each outreach health worker visiting several patients in the field, and reporting post-hoc on data collected during these visits. The software originally had functions for showing this visit schedule for upcoming appointments, but not features specifically targeted at patients visiting a health clinic and tracking those who missed their appointment - so called lost-to-followup. These functions were added during this project, with the options to easily add comments to each patient, send text messages and set their status within the program.

Patient dashboard

The medical practitioners in the project wanted a patient dashboard that quickly gave an overview of the patient’s previous history and medical information at the point of care. This screen would be used by medical staff while examining the patient. The implemented screen has information such as personal data, list of active and past programs, link to children or parent, comments entered and text messages sent to this patient. The screen also allows for data entry and a flexible management of the scheduled visits within the patient’s program as well as linking this patient to a specific health worker.

Program definitions

The earlier program software support had been rigid with strong inscriptions, and the
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Software was changed to allow for a more flexible program definition, based on the requirements of combining multiple programs into one and flexibility on how many encounters there would be for each patient. Automatic reminders were added to the program definitions, allowing configurable text alerts and multiple reminders per program stage.

**Privacy**

The software also went through several revisions where the privacy of health data was improved. The definition of user roles and access rights were improved, and audit logs for access to private data was also introduced. A feature to hide or not use patient’s real names was also implemented.

**Mobile features**

The new mobile features included text reminders to patients about scheduled visits, educational text messages and improved interfaces on mobile phones to register patients, enroll them in programs, access and enter patient data. SMS commands to check patient status was discussed and will be implemented in the continued project, providing a very simple patient dashboard accessible via SMS.

During training sessions, the health staff was clearly more used to mobile phones than computers with web browsers. One of the health staff smiled when we pointed this out and said that “In Uganda, the mobile is the PC”. It became obvious during the project that the solution had to be accessible to different health workers on different devices and technologies, including SMS, Mobile Java, Mobile browsers, web and even tablets. Health workers work in heterogeneous contexts, and supporting the range of interfaces was important for making an accessible solution across the health service, while also increasing the interpretive flexibility pertaining to the relationship between the individual user and the tracking information system.

**Summary of data capturing tools**

The existing data entry tools support different tasks and work practices that do not unite the clinical and the health information management functions in a smooth and straightforward way. These differences are manifested in tensions such as: Which data should be stored?; where should the data be stored?; who should enter the data and who should have access to it?; when is the data entered?; when can the data be retrieved? Some of the findings are summarized in Table 1.

<p>| Table 1. Summary of the characteristics of existing paper based data capture tools. |
|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| Which data | How is data stored? | Who has access to data? | When and how is data entered? | How and when can data be retrieved? |</p>
<table>
<thead>
<tr>
<th><strong>Mother health passport</strong></th>
<th>Medical info related to pregnancy</th>
<th>Booklet brought by mother.</th>
<th>Only people the patient shows it to.</th>
<th>During the patient encounter. At point-of-care.</th>
<th>When the mother wants it to.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Registry</strong></td>
<td>Information relevant for HMIS reporting.</td>
<td>Book at the registry desk.</td>
<td>Health staff at one clinic.</td>
<td>Before and after patient visit.</td>
<td>By paging through the registry.</td>
</tr>
<tr>
<td><strong>Longitudinal Registry</strong></td>
<td>Medical info across different stages.</td>
<td>Book at registry desk (Many registry desks, but only one book)</td>
<td>Health staff at one ward. It is a single book, kept in one place within the health clinic.</td>
<td>Before and after patient visit.</td>
<td>By paging through the registry.</td>
</tr>
<tr>
<td><strong>Patient Journal (some hospitals)</strong></td>
<td>Rich medical info related to pregnancy, lab results etc.</td>
<td>Stored in the delivery ward. Picked up by other departments on demand.</td>
<td>Health staff at one hospital.</td>
<td>During the patient encounter. At point-of-care.</td>
<td>By number. All visits stored in one file.</td>
</tr>
<tr>
<td><strong>Electronic Person Tracking Information system designed in this project (Entry using web and mobile phone)</strong></td>
<td>Subset of data, important for clinical follow-up.</td>
<td>Shared online database, maintained at a central national or international location.</td>
<td>Health staff at all clinics. Alerts and informational messages are sent to patient and CHWs, containing limited info.</td>
<td>At point-of-care if health staff have a computer or phone, or after visit at a central computer.</td>
<td>Using mobile phone or PC. Search for name/id and get all visits, or search by status, e.g. overdue.</td>
</tr>
</tbody>
</table>

**Analysis**

The applied cycles of action design research, with building software, intervening and evaluating the outcome led to an emerging understanding of multiple rationalities present within the group of practitioners, users and other stakeholders. These rationalities became important foundations for design principles. The manifested principles were inscribed into subsequent software development cycles, thus inscribing the rationalities into the software design.

At the outset of the project, it was important to learn how the existing tools were being used, understanding which benefits and drawbacks they presented. While studying these tools, it became apparent that they had different rationalities inscribed into them, each in slight conflict with the others. Combining the tools into a single software
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package would mean combining multiple rationalities into a single software system.

When multiple rationalities caused conflicting design principles, there was a negotiation within the team on how they should be materialized in the system. In some cases, the multiple rationalities could be supported simultaneously by adding multiple screens. In other cases, trade-off decisions had to be made which partly excluded one rationality in the design of the ensemble artifact, as was the case for whether to use the system to replace the registry books entirely or just collect data relevant for the clinical follow-up of the patient. In some cases, trade-offs were achieved by loosening inscriptions, such as making program definitions more flexible, thus increasing the interpretive flexibility of the solution.

The project learnt from other deployments, both because previous projects had inscribed design principles into the open source software artifact, but also through meetings and discussions with other project teams. Because the projects used a common open source code base and also used the same development team, the co-negotiation of common design principles that bridged contexts was important. When the rationalities behind the implemented functions were not clearly communicated, it led to other projects misunderstanding the intentions of several screens, causing a redesign which broke the derived design principles.

**Fig. 6** shows the cyclical rationality-guided design process of identifying rationalities, negotiation design principles, inscribing these into the software and practices and the learning through demonstrations, training, testing and real use. The model is based loosely on ADR (Sein et al 2011), but is changed to stress the empirical findings of this case and the theoretical lens of rationalities.

Who is responsible for continuity of care?

The empirical material indicates multiple coexisting rationalities of how pregnant women should be followed up. As materialized in the Mother health passport, some people argue that persons should be in control of their own data and decide for themselves which health facility they wish to attend. Others argue that the health service should take
on the responsibility for following up persons, because too many mothers fail to meet for appointments.

The personal-choice rationality may be informed by liberalist values of individual rights to seek the health services that are perceived as best by the individual. However, it can also be seen as a rationale of convenience, on behalf of the health care providers, who are overburdened and lack the necessary resources for tracking and following up patients, or even a lack of appreciation and sense of responsibility for the patient’s continuity of care. In parts of the Ugandan ANC system the tracking function is placed entirely in the hands of the patient, who brings her own data in the form of a paper booklet to each health service visit. This logic provides flexibility to the health clinic, and they focus on treating the patients who take responsibility for their own health, not having to allocate resources for following up mothers who do not attend their scheduled visits.

The personal-choice rationality has an important impact on the electronic health information system. When the mother migrates between health facilities, it makes planning more difficult and also creates the demand for distributing health information across these facilities. If the mother always came back to the same facility, her information could be kept in that facility and it would be clear who had the responsibility to follow her up if she did not arrive.

**Two different tracking rationalities – health management and clinical**

Our research also shows that the concept of tracking varies. From a public health management perspective, tracking is important as a tool to monitor the health situation in a country more accurately. Information fetched from tracking programs that use individual patient data can enable powerful analysis that again is fed back into managing programs and distributing resources. From this perspective, tracking is not there so much to improve the health of the individual patient, but to monitor and improve the effectiveness of the overall health services. Collecting and centrally storing historical personal data is justified because individualized data is perceived to be more accurate than aggregate figures and can be traced back to the actual event for verification. More detailed analysis on the correlation between types of health related events and specific diseases can be performed based on personal data.

On the other hand, many health staff such as clinicians have a different view of tracking that is less centered on epidemiological concepts and focused more on treating the individual patient. For them, the follow-up process extends beyond the recording of historical data, to incorporate tasks such as calling or going to see the patient, adapting the medication to the patient’s symptoms, referring risk patients to more advanced health facilities etc. This process is pursued to improve the health outcome of the individual patient being tracked, not to collect data that is useful at a national level. This rationality was more apparent with doctors and midwives who had been in direct
contact with the patient and who also have been trained in professional medical care, thus drawing legitimacy to their arguments from the rationality of professional medicine.

One of the participants in a training session clearly expressed this difference between public health and clinical rationalities. He was a medical doctor at a hospital, and had also worked with electronic medical record systems. “We want to link the data to the patient directly. I would have preferred to keep the [HMIS] system at the district level, because the district is aggregating. The facility would like to analyze something more to the benefit for the patient. This is what I’m talking about. The patient. What benefit [can this system have to the patient]”.

We call these rationalities the ‘clinical tracking rationality’ vs. the ‘public health management tracking rationality’, keeping in mind that they are not always contradictory. In fact, we have seen people ‘change hats’ during a discussion, arguing for both rationalities. Most of our interviewees would recognize and acknowledge both rationalities when it was described to them, but not all agreed that they were different rationalities or were contradicting.

During the design process, the clinical tracking rationality would tend to focus more on features such as point-of-care access to data and a good patient dashboard, but may also accept trade-offs such as only logging data for critical cases or restricting the dataset to what is clinically important to share between facilities. The public health tracking camp would argue that enough data has to be collected to be analyzed post-hoc, and may argue that all the data in the registries should be collected. Supporters of the public health tracking logic wanted to use the system to completely replace the registry books. There was a clear design conflict in the project between the minimum clinical dataset required to follow up and identify critical cases, contradicted by the complete set of data filled into the HMIS registry books.

One of the major information system design revisions was the introduction of lost to follow-up screen, listing persons who were lost-to-follow-up and providing simple interfaces for sending SMS messages and reminders to patients and community health workers. These features were added to support a clinical tracking rationality, and had not been perceived as relevant from the historical health management view of the system.

Realizing that there were multiple rationalities led to the design decision of enabling two separate data entry screens, in order to accommodate multiple programmes of action. The patient dashboard was streamlined to provide clinical information and data entry at the point-of-care, while the post-hoc data entry screen was optimized for data entry by a data entry clerk after the person had left. The patient dashboard was challenging to implement on the mobile phone, because of the limited screen real estate and the large amount of data to be presented simultaneously while the health staff sits in front of the patient. On the other hand, having to design the solution for use on mobile phones
helped limit the functionality to the absolutely essential and also guided the designers to make simpler web based data screens.

**Structure vs flexibility of information**

In HMIS systems, it is a good design principle to use structured data models that can be aggregated and analyzed in larger contexts. Many medical journal systems are much less structured, and allow for more flexibility through text fields that is filled in by health staff. The initial DHIS2 software was following the HMIS logic of using only structured data and forms, but during this project more free-text fields were added, allowing text comments on stages and patients to increase the clinical flexibility. These comments are not useful to aggregate and analyze at a national level, but are useful within the clinical rationality to provide individual treatment and care.

**Discussion and concluding remarks**

**Multiple rationalities informing information systems design**

We have identified three important health information systems rationalities. Some actors view tracking as unnecessary, unmanageable or not cost-effective, and would rather place the responsibility for follow-up with the person. For those who see tracking as important, the tracking rationality seems to manifest itself through two distinct views, informed by larger historically constructed institutions. One is a managerial rationality focused on running a best possible health organization that improves “health for all” at a national or regional level. Another is a more clinically focused logic, which focuses on treating the individual and improving the services provided to the individual at the point-of-care, representing a more local-comprehensive scope.

The design principles that emerged during the project, as a result of identifying the multiple rationalities, were that the tracking information system would have to i) support personal choice and freedom to select facility, ii) support the clinical use and sharing of person specific health data, including the two offline activities of planning visits and finding patients who were lost to follow-up, iii) support health management data collection for statistical analysis and public health management. These theory-driven design principles were developed into the artifact, through applying inscriptions such as changed wording, new screens, implementing new technologies such as SMS messaging and changed work flow. Because each of the design principles represent different and to some extent conflicting rationalities, the design process involved a careful balance of design principles, where the iterative research process was used actively to explore the effects of giving too much weight to single principles. The exact balance of competing design principles was clearly context-dependent.

The DHIS Tracker development is an ongoing iterative project, and it is expected that further enhancements will be included throughout the lifetime of the project. The
learning from the research project in Uganda has also helped inform other DHIS implementations in other countries, as these design principles have been inscribed into the global open source software.

The information system now supports the combination of point-of-care data management and post-visit data management; merging a data warehouse containing structured patient data with support for unstructured comments to be used at the clinical level. Features for connecting the community health workers to the health staff have also been implemented, integrating the community health worker into the process of providing continuity of care.

Conflicting rationalities between designers and potential users can lead to the lack of adoption of a particular system, or failures to integrate and coordinate the system with relevant health programs or supporting activities. It is therefore important to give voice to diverging rationalities and recognize the multiplicity of resulting design principles at a point in time when the solution is still being defined, opening up for interpretive flexibility. Supporting these different rationalities is expected to provide a more successful deployment of the software platform, enabling it to be part of the shared and open health infrastructure that different actors support and maintain.

This paper focuses on a single project where the DHIS2 Tracker software is being deployed, but because the identical software is deployed simultaneously in different projects, each affecting the code base in varying ways, it may also have been useful to look more at the co-negotiation of design principles across projects, considering the longitudinal biography of the DHIS2 tracker artifact. This may be an area for future research. There are also many other patient tracking systems available, although few are as tightly bound to the national routine reporting mechanisms as DHIS2. It may be interesting to consider if similar rationalities affect and shape other patient record deployments.
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The use of personas in software development: Advantages, obstacles and experiences in practice

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Abstract. Personas has been promoted as a strong tool for providing software developers with a better understanding of the prospective users of their software. This paper reports from a questionnaire survey regarding the knowledge about the method and the usage of personas in software development companies. It was conducted in a small geographical area to establish if personas is a widely used method within all companies in the chosen region. The purpose of the questionnaire survey was to determine whether software development companies in that area used personas during the development process. The questionnaire was answered by 69 companies from the chosen region. Several issues were identified as reasons for not either not using the method or for poor application of the method. For companies not using the method at all we found two obstacles; lack of knowledge about the method and lack of resources. For companies using the method, we found additionally two obstacles; Sparse or badly designed persona characters or personas not being used in the entire development process.

Keywords: Personas, software development, questionnaire survey, grounded theory.

1 Introduction

Looking that the related work four issues stand out; 1) It is reported that software developers lack knowledge and understanding of their users, their work, and goals [1,3] 2) the persona method has been promoted as a strong tool for providing the software developers with a better understanding of the potential users [7].

3) Several papers conclude that the use of personas has been a success [10,12] 4) the persona method is not necessarily an incorporated part of the toolbox in the software development industry [15] and the industry might have problems using personas [2]. Our study will be related to these four issues in the discussion.

The literature provides several examples about what will happen if the personas method are used to its full potential. However there are still unanswered questions about what it means if developers are not using personas to represent their user
groups. Could this lead to; 1) software developers unfamiliar with the user groups’ actual needs 2) software without relevant features 3) less profit than if the software was developed to its full potential. Unfortunately the literature provide not much information about these speculations. Other aspects of persona usage are also unexplored.

The purpose of this paper is to explore to what extent software development companies use personas and whether the industry use the method as proposed in the literature. The paper reports from a study in a defined region in one country (blinded for review) and is part of a larger study on how the persona method is applied. This paper reports if companies in this defined region have had success using personas and incorporating the method as a part of their development toolbox.

The greatest advantage of using one defined region is that it is possible go get in touch with all companies located in the region, which gives a more complete picture than picking out companies located in several regions or countries.

The following section presents a more detailed description of the work related to this study. It describes how personas are constructed and used, including the pitfalls to avoid. Section 3 presents the methods used for data collection, which consisted of an online questionnaire with both open and closed questions. Grounded theory and coding was used for analyzing the qualitative content of the questionnaire. Section 4 presents the results from the questionnaire. Section 5 provides a discussion of the results in a broader context. Finally, section 6 provides the conclusion.

2 The method and usage of personas in related work

The common understanding of the persona method is, that a persona is a description of a fictitious person [6,21] based on data. The main way to represent a persona is as a text describing the fictional user and a photo depicting the fictional user.

The literature offers four different perspectives regarding personas [18]: 1) Cooper’s goal-directed perspective 2) Grudin, Pruitt and Adlin’s role-based perspective 3) The engaging perspective, which emphasizes how the story can engage the reader These three perspectives agree that the persona descriptions should be founded on data. However, 4) the fiction-based perspective, does not include data as basis for persona description, but creates personas from the designers’ intuition and assumptions. Even though the persona method has been around for more than a decade, when comparing the four perspectives, it is still unclear what and how much background material is required to create personas [17].

The common perceived benefits of personas are two-fold: 1) when designing products the method facilitates that designers remember that they differ from the end-users and 2) the method enables designers to envision the end-user’s needs and wants. Furthermore in the design process the personas increase the focus on users and their needs, the method is an effective communication tool, at the persona description get direct design influence and lead to better design decisions and definition of the product’s feature set [6, 7, 12, 13, 14, 16, 21].
Problems have been reported regarding creation and distribution of the developed personas [2, 22]. The descriptions have been perceived as unreliable and not well communicated. Also developers lacked understanding of how to use the personas [2, 21, 22].

The method itself is criticized for being too founded on qualitative data and as a consequence of that - non-scientific, being difficult to implement, not being able to describe actual people as it only portrays characteristics, and for preventing designers from meeting actual users [1]. Moreover the unsolved question about how many users one persona can represent is perceived as problematic [5].

Some have tried to prevent poor use of the personas method. e.g. Faily and Flechais [11] describes regularly sending information about the personas to the team, to ensure that the designers and developers consider the personas in the design process. They supported use by suggesting letting the creators hand over use instructions and provide tools that support the developers’ usage [11]. Problems in application are reported as also incorporating the mindset of the developers, which is documented by both Blomquist and Arvola [2] and Pruitt and Adlin [21].

In line with this Matthews et. al. [15] found that mainly designers and user experience professionals who had some training in personas creation and had done extensive work with personas used them as described by others [6, 7, 21, 22]. These designers had a very positive attitude towards the method. Those who had a minor use of personas had a moderate or neutral opinion regarding personas, and those who had not worked with personas had a negative or indifferent opinion regarding the method.

3 Method

In order to study the usage of personas and the obstacles towards the prevalence of the method we conducted a questionnaire study. First we conducted an online questionnaire survey and secondly we analyzed the answers of the open questions using Grounded Theory [8].

3.1 Participants

We focused on companies that were primarily developing software, either for internal or external use. We decided to exclude companies that focused solely on hardware development. We ended up with software companies with the following characteristics:

- The company develops software with a graphical user interface (e.g. mobile phones, games, web applications, PC or PDA software).
- The company develops for customers or for internal use.
- The company is geographically located within a specific minor geographical area.
- The company employs more than a single person and it is not a hobby company.

We chose to focus on a well-defined geographical area in order to do as complete a survey as possible and finding the level of knowledge about the personas method in that area.

To obtain a list with as many software development companies as possible we acquired two lists containing software companies located in the defined region. This was followed by a search on LinkedIn to include companies that only had a smaller development department in the region and had the headquarter located either in another region or in another country.

Table 1 shows the process of obtaining the total amount of 134 software companies in the region, which was within the scope of this study.

<table>
<thead>
<tr>
<th>Companies on list</th>
<th>Out of scope or gone out of business</th>
<th>Applicable companies</th>
</tr>
</thead>
<tbody>
<tr>
<td>List 1</td>
<td>77</td>
<td>-35</td>
</tr>
<tr>
<td>List 2</td>
<td>139</td>
<td>-63</td>
</tr>
<tr>
<td>LinkedIn</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total number of applicable companies</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 3.2 Data Collection

We created an online questionnaire using the tool SurveyXact (www.surveyxact.com). The first part of the questionnaire was made to gain more information about the responder and his or her place of employment (e.g., job function, business, number of employees in the company and line of business, within software development).

The second part was made to get statistics on the number of responders who knew what a persona was and what a persona was used for. The third part was about the use of personas in the companies. This third part was only filled out by the people who answered that they knew of, and worked with personas.

The distribution of the questionnaire was done in two ways. First, 43 companies in which we had a known contact person was contacted by phone. Then the remaining 91 of 134 companies was contacted to acquire a contact person. This ended in 112 emails sent out. Of the 22 companies that we did not send an email with a link to the questionnaire, eight declined to participate and for the rest we could not locate a viable phone number or email address. The recipients were given three weeks to fill out the survey.
The data collection process resulted in 69 responses in total or a response rate of 51.5%. Of the 69 responders nine did not finish the questionnaire, leaving us with 60 complete responses.

3.3 Data Analysis

The aim of grounded theory are described as “building theory, not testing theory” [20]. This means that theory should emerge while the analysis takes place and should not be used to prove an already existing theory.

The data analysis began before the questionnaire was closed. When the questionnaire was closed, the data was updated with the results from the latest incoming questionnaires. In the questionnaire we used both open and closed questions. To quantify the open questions, the grounded theory approach as described by Corbin and Strauss [8] was used as an analysis method. All quantifiable data was analyzed quantitatively.

Coding was used to analyze the open questions. The most interesting question to use coding on was “How would you explain what a persona is and how it is used?”.

For this question the following coding categories were assigned; method (for creating personas), finding target user group, when in the process the personas are used and how they are used. Coding was not added successfully to other open questions since the respondents mainly answered in short sentences and respondents were sent directly to the end of the questionnaire when ever they answered “No”. E.g. “Have you ever heard about personas?” or “Have you ever worked with personas?” meaning that the number of respondents dropped for every question. Since it makes no sense to ask a respondent about their knowledge about the use of personas if they have already indicated they have never heard about personas.

4 Results

This section presents the results obtained from the questionnaire study.

4.1 Knowledge about the personas method

The results of the questionnaire indicates that 27 out of 60 respondents or 45% have heard about personas. 15 responders out of 60 have worked with personas. Seven responders out of 60 are using personas as a development tool in their current job. Meaning that 11.5% of our responding companies are currently using personas as a development tool and 55% of the responders have never heard about the method.

The distribution across different sizes of companies is shown in Table 2. In this table the dispersion across company size and the number of responders familiar with personas.
Table 2. Distribution across companies size.

<table>
<thead>
<tr>
<th>Number of employees</th>
<th>1-10</th>
<th>11-50</th>
<th>51-200</th>
<th>&gt;200</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using personas</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Not using personas</td>
<td>23</td>
<td>16</td>
<td>8</td>
<td>6</td>
<td>53</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>24</strong></td>
<td><strong>19</strong></td>
<td><strong>9</strong></td>
<td><strong>8</strong></td>
<td><strong>60</strong></td>
</tr>
</tbody>
</table>

In Table 3 the 53 responding companies that do not use personas have been grouped. Of university students, but didn't find the personas method useful for other projects. The other two respondents stated that their respective companies stopped using personas because they didn't find the developed personas applicable in their line of development. 13 respondents stated they had heard about the personas method but had never worked with creating personas themselves and four respondents had worked with creating personas in an earlier employment or while studying.

Table 3. Respondents knowledge about personas – from companies that does not use them.

<table>
<thead>
<tr>
<th>Number of employees</th>
<th>1-10</th>
<th>11-50</th>
<th>51-200</th>
<th>&gt;200</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never heard about them</td>
<td>18</td>
<td>7</td>
<td>6</td>
<td>2</td>
<td>33</td>
</tr>
<tr>
<td>Have used personas, but stopped</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Heard about personas, but don't use them</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>13</td>
</tr>
<tr>
<td>Worked with personas in other employment or while studying</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>25</strong></td>
<td><strong>15</strong></td>
<td><strong>8</strong></td>
<td><strong>5</strong></td>
<td><strong>53</strong></td>
</tr>
</tbody>
</table>

4.2 Understanding of personas and their use

An open question in the questionnaire was used to reveal all the participating companies understanding of the term “persona”. Figure 1 shows the distribution among four categories of understanding. “Personas being an imaginary user”, were expressed by 22 respondents. e.g. “a fictitious user of the system you are developing”.

“Personas are used as a validation of the design”, were expressed by 17 respondents. e.g. “making sure user needs are met by a given design”.

A persona “being a representation of a larger user segment” were expressed by 13 respondents, e.g. “description of a set of characteristics characterizing a certain group of users’ behavioral patterns”.

And personas “being a tool for making sure to keep the users and their needs in mind all the way through the development process” were recognized by four respondents. e.g. “...the personas are used as focus points for planning the entire product life cycle”.
This means that personas by far are recognized as fictionalized users used as a tool for designing features requested by users and user segments. On the other hand no more than four respondents expressed that personas should be used through the entire development cycle. Which means that the common idea seems to be that personas are mainly a tool for identifying some aspects of the user group and not so much a tool to be used during the entire development process.

Figure 1. How respondents described personas and their usage

Personas in use. Respondents who did use personas in their company described several strengths of using personas in the development process.

One described it as being a useful tool to support that a system is usable by all user types; “...it is very important for us that the system is very easy to use, which is why mapping the user types are important”. Another respondent claimed personas was used primarily because their supplier suggested they should. However they do see the need for using personas as they are designing for many different purposes and lots of different users.

Personas were also described as being usable for clarifying constructs.

In one of the closed questions the respondents using personas were asked to indicate why they found personas to be a useful tool. Of these, three responders indicated personas helped the team sharing a specific and consistent understanding of several, different user groups. Two respondents indicated personas are useful for guiding suggested solutions to match the user needs. Two respondents indicated personas was useful to help developers keep focus on the users since they turn users into real people. Two respondents indicated personas being useful for understanding the business area of the system. Finally one responded that personas could help the team understand how the product should be marketed and sold.
4.3 Knowledge about – and experience with personas

In our study, several issues were identified as the reason for either not using the method or for poor application. We decided to categorize the issues as follows:

Not using the method:
- Lack of knowledge about the method
- Lack of resources

Poor application:
- Sparse or badly designed descriptions
- Not integrated in the development process

Lack of knowledge (of the method). This seems to be a major obstacle regarding usage of personas, the analysis showed that 55% of the respondents had never heard about the concept or method.

Of the respondents who had never heard about personas, 10 people were CEOs, owners or partners (primarily in micro- or small sized companies), five were managers in IT and three worked as sales managers (all three in medium sized companies). This could indicate that the chance of allocating resources to personas development might be slim.

One respondent indicated that the company did not recognize the importance for any communicative tools. “The company has downsized and has eliminated the communications position since it is primarily a production company and they don’t really understand the importance of e.g. personas, ambassadors, first movers, e.g. ...or communication in general for that matter”.

This means that in these companies the knowledge about the personas method will not come from management, and even if employees bring the knowledge about personas into the companies funding probably not being allocated.

Lack of resources (time and funding). The analysis found that personas are mainly created if a need has been localized for a specific project and “cutting a corner” when using personas seems to be the general idea. Some only use personas to the point that they think it creates value for the customer and thereby, profit for the company. Also when asked in the survey how much resources were allocated to develop personas, the general answer was zero.

Sparse descriptions. When a persona is created too superficial the persona will lack the depth that would normally be the strength of the method, making the personas untrustworthy and unusable. This contradict with what helps making personas a useful tool that lead to better design decisions [6, 12, 13, 14, 16, 21]. When a persona is created with much detail and described as a whole character and not a stereotype, it will support the design and innovation process.
One respondent indicated difficulty in finding a suitable template for the descriptions and that they wanted to create short descriptions instead of detailed character descriptions. “It is hard to find good templates for constructing personas. We ended up with a few lines in bullets describing each persona, which could be used as a fast reference. Instead of a large scheme describing lots of details nobody wanted to read anyway”.

This corresponds with the descriptions of personas by some respondents answering the questionnaire. These descriptions were quite superficial and did not describe individual personas but mainly a job role and a use situation.

**Not integrated in development.** This ties in with the finding of lacking resources. The superficial personas are created to be used in the design process. The descriptions are not meant to be used in any other stages of the design process. Furthermore they are not used to keep reminding neither developers nor designers about the end-user’s and their needs. This means that the potential of the personas method is not explored.

## 5 Discussion

Next, the results will be discussed in relation to the related work.

### 5.1 Lack of knowledge and understanding of the users

Software developers lack knowledge and understanding of their users, e.g. their work and goals [1,3]. Among our findings was poor application of the method. This relates perfectly to the first point about developers lacking knowledge and understanding of the users, since the persona's descriptions, if applied, are made sparse and only used in a very narrow time frame of the development process. One of our findings was that the development of the personas lacked resources, since none of our respondents had a budget allocated specifically for the personas development.

This goes against the related work stating that personas can lead to better design decisions [6, 12, 13, 14, 16, 21]. If personas are created without more than use-related details, at best it will not create any value at all. Or it could lead developers down a wrong path.

### 5.2 Personas can help developers understand users

The persona method has been promoted as a strong tool for providing software developers with a better understanding of the potential users [7]. In our questionnaire it was indicated that the most useful thing when using the personas method was that personas helped the team share a specific and consistent understanding of several, different user groups.
5.3 **Personas used as a successful tool**

Several papers conclude the use of personas has been a success [10,12]. This corresponds with the experiences of our respondents who are using personas. The tool is described as useful to help developers understand the users and their needs, especially if the system needs to be usable for several different types of end users.

5.4 **Personas are not incorporated in the industry**

The persona method is not necessarily an incorporated part of the toolbox in the software development industry and the industry might have problems using personas [2]. Since only 44% of our respondents have even heard about the personas method and less than 12% have worked with creating personas, it is fair to say that personas are not an integrated tool in the software development industry in this region. Also, we found that only four respondents indicated that personas should be used through the entire development process, meaning that even if personas are used, they are not necessarily used to their full potential.

In companies using personas, the method is used mainly to identify types of users or use cases. The personas are kept to a minimum and not focused on describing whole characters. As in the related work we found developers lacking understanding of how to use personas to gain most from the usage [2,7,22].

The reasons for that could be a combination of several aspects. We found that resources are not allocated specifically for creating personas which corresponds with the area of usability in general [1,22,23].

The full potential of persona usage does not seem to have caught on in the industry. Matthews, Judge and Whittaker [15] found a connection between the perception of personas and to what extent the method was used and the amount of training the developers had had using personas.

6 **Conclusion**

The purpose of this paper was to explore to what extent personas were used by software development companies in a specific geographical area and whether the industry used personas as proposed by the literature. To accomplish this, we conducted a questionnaire survey with usable responses from 60 software development companies.

The study showed that 7 out of the 60 software development companies used personas. The results from the questionnaire also uncovered four issues. Lack of knowledge of the method as such and lack of resources both related to companies not using the personas method. Sparse or badly designed descriptions or not part of the development process both related to poor application, when using the method.

Our findings are well-supported by other studies described in the related work section. Despite this, our study contributes differently than the ones described in the
related work. Since this study is focusing on making a complete study within a limited geographical area.

As future work it would be interesting to get more than one employee from each company to fill out the questionnaire. This might show a different result since different employees could have a different understanding of personas and their use.

Follow-up interviews could also be interesting. This type of study could end up providing enough information to disseminate the knowledge about the personas method and their usage.

7  Acknowledgements

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We would like to thank the companies and employees that participated in our questionnaire survey.

8  References

The impact of e-procurement on industrial buyer-supplier relationships – a suggested conceptual framework

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Abstract. This paper presents a selective literature review of research on how electronic procurement tools affect industrial B2B buyer-supplier relationships, and suggests a conceptual framework for studies of the impact of e-procurement on buyer-supplier relationships. Most tension is reported around electronic reverse auctions with large cost reductions on the buyer side and adverse reactions on the supplier side. Implementation of other e-procurement tools has enhanced strategic integration between the customer and the supplier organizations. The literature crystallizes certain aspects of buyer-supplier relationships affected. These are translated into the conceptual model as five B2B relationship attributes: long term, cooperativity, profitability, transparency, and trust.

Keywords: e-procurement, e-purchasing, e-sourcing, buyer-supplier relationship, electronic reverse auctions

1 Introduction

Trade between companies affects the individual employee's life as much as it determines the organization's strategy and structure. The relationship between the company that buys and the company that supplies defines the work situation of the individuals involved on both sides of the transaction. Because the buyer-supplier relationship plays such a central role in business, it means that changing purchasing technology affects the lives of many employees in most industries. The introduction and dissemination of the Internet has led to extensive changes in the business market (B2B) related to procurement in some larger businesses in the private and public sector, not least for the sales function of their suppliers. Purchasing's function is to provide goods and services, raw materials, intermediate products and components to the right quality and time, and at the lowest possible cost. This makes it a crucial part of the value chain. According to Van Weele (2005), more than 50% of most companies' costs are incurred by procurement. An industrial company's competitive power is determined by its ability to source material and components at the right prize, quality, and received at the right time. In order to keep or improve its market position it must contiuousely seek to implement more effective purchasing processes.
"Web-enabled applications for business-to-business (B2B) procurement are not only expected to reduce the cost of purchasing process but also to alter the activities of purchasing, transform the purchasing process from an operational into a strategic activity, and provide opportunities for improving market coordination by reducing asset specificity and by making additional partners available" (Ho, Tai et al. 2008).

However, there is also some tension involved in the introduction of new information technology in procurement. Reports of the commotion electronic reverse auctions has made among some vendors, i.e. Sivertsen (2006), illustrates the ability e-procurement systems possess in influencing buyer-supplier relationships. For case studies and other research into the interplay between e-procurement systems and buyer-supplier relationships, a conceptual framework is necessary. This paper suggests such a framework.

In this paper, section 2 describes briefly the historical background of e-procurement, and explains some basic terminology. Section 3 describes how the selective literature review was carried out. Section 4 presents its general findings, while section 5 presents works that form a basis for a conceptual framework. In section 6 the conceptual framework is presented, and section 7 concludes the paper.

2 E-procurement in perspective

Electronic procurement was adopted long before the Internet became available outside research institutions. In the 1980s and the next decade, Material Requirements Planning (MRP) systems evolved into Enterprise Resource Planning (ERP) systems. At the beginning of the 1990s, establishing EDI (Electronic Data Interchange) was a priority for many businesses. Today, Electronic Procurement is frequently defined as the sourcing of goods or services via electronic means, usually through the Internet (Schoenherr and Tummala 2007).

The author has experienced slight differences in how central purchasing terms are used in documents and organizations, and recommends researchers entering an organization for the first time to pay attention to how these terms are used. In this paper, Electronic procurement (e-procurement) spans many business activities assisted by electronic means. Procurement covers buying activities as they constitute supply management in industrial organizations. In many organizations, acquisition or buying of services is called contracting, while that of goods is called purchasing. To select a supplier of a service or a component to your product, is named sourcing. A tender is an offer given by a supplier describing prize, product specifications, and relevant terms of delivery and payment. Suppliers may compete to win orders through bidding processes. The most competitive forms of bidding is online electronic reverse auctions (e-RA's). Electronic gathering and disseminating information about suppliers, prizes, quality, and product specifications, is called e-informing.
3 Methodology

Schoenherr and Tummala (2007) performed a structured literature review on electronic procurement, finding outlets of articles covering electronic procurement in as much as 80 various journals. They found twelve journals with four or more articles concerning e-procurement, but no dominant journal emerged. Thus, the picture of research on e-procurement is rather fragmented. In order to focus on the customer / supplier relationship it may be useful to first identify what motivates introduction of e-procurement to an organization and the electronic tools implemented to achieve those goals.

As we have seen, the literature on e-procurement is rather fragmented. The identification of interesting research to the topic of e-procurement's impact on buyer-supplier relationships has been based on inspecting the abstracts from the first pages of Google Scholar (GS) hits on search terms "e-procurement", "electronic procurement", and "electronic reverse auctions". From these selected articles, additional works are identified by citations. Science Direct has been used to supplement the findings from GS.

After searching by these single arguments, a new GS search has been performed by a combined argument "e-procurement buyer supplier". This search was sorted on relevance, and the first 40 abstracts were inspected. Out of these works were read, and citations in these were used to build a picture of the main debates in this field. Finally, a supplementary search on works not older than 2009 was conducted.

The findings were grouped relating to weather they contributed to the understanding of how the different types of e-procurement influence relationships directly or indirectly, or if they contributed more directly to the impact on buyer-supplier relationships and could support the development of a conceptual framework.

4 Review

Several writers advocate e-procurement as a means of added value creation, for instance Presutti Jr (2003) and Davila, Gupta et al. (2003). Ronchi, Brun et al. (2010) identify the six most significant drivers for e-procurement adoption as efficiency, decentralisation, transparency, control, maverick-buying reduction, and supply-base rationalisation. By developing a framework based on rent generation, Knudsen (2003) finds that e-procurement tools are fully viable for creating buying-power advantage, moderately viable for utilizing pooling and valuable resources, and marginally viable for creating new business opportunities. He advocates a careful examination of the particular supplier relationship before implementation of any e-procurement tools, because building on buying-power advantage may result in "arm's-length type supplier relationships, and that might not be wanted as it runs counter to the present progression of having fewer but closer relationships with the suppliers". The industry moves towards a reduced number of suppliers, at the same time with tighter integration with these, as described by Harland (2005). This trend was encouraged by Peter Kraljic (1983) in his article "Purchasing must Become Supply Management". He sums up strategic implications of the buying organization's purchasing portfolio into exploitation of buyer strength where it is strong, opportunism where it is balanced by supplier strength, and
seek diversification where suppliers are in the stronger end. A condensed Kraljic Matrix is presented by Koliousis (2006):

![Figure 1: Condenced Kraljic matrix](image)

The horizontal axis measures the value of the input while the vertical the criticality to the supply chain. The text in the boxes indicate what kind of attention management should pay to parts of the purchasing portfolio. Especially the upper right quadrant encourages long-term supply relationships. A dramatic approach to this is the "Open Books" policy: "The open books approach requires the supplier to open its books to the buying organization to help identify high cost areas, and then work together to reduce the costs in those areas. In such circumstances, the savings generated are often shared. The analysis often will be done by a team representing both the buyer and the supplier, rather than by an individual. This allows for maximum idea generation and feedback. This contrasts to opening the supplier's books for purposes of cost analysis, where the costs are merely verified for reasonableness, rather than improvement. Clearly, such an approach is feasible only in situations where the organizations have a mutual commitment to improvement, as well as a high level of trust. (…) Such an approach is strategic in that it helps the organization be more competitive by continually improving the cost structure of its supply base-and, thus, its own cost structure." (Ellram 1996). The "Open Books" concept highlights the trend towards further integration between the buying and the supplying organizations and their systems.

In a widely sited article, de Boer, Harink et al. (2002) list six forms of e-procurement: e-MRO (goods and services ordered for maintenance, repair, and operating); web-based ERP (enterprise resource planning); e-sourcing; e-tendering; e-reverse auctioning; and e-informing (gathering and distributing purchasing information).

### 4.1 e-MRO

MRO stands for maintenance, repair, and operating. These goods and services are not put directly into the product that is the output of production process, but are a necessary part of what a company needs in order to manufacture its products. MRO-goods are often referred to as "indirect goods". For most companies this means that diverse ranges of products are required. Time-consuming "maverick buying" – unstructured acquisition of goods from
The diversity of products to be procured in the MRO domain represents an extra challenge to the buyer/supplier relationships. One approach is to transact over the Internet with a single MRO provider who acts as a broker. In turn, the MRO provider interacts on behalf of the company with the relevant suppliers and service providers. Michaelides, Ho et al. (2003) compare this model with the traditional MRO purchasing model and a network relationship e-MRO model where multiple buying companies and multiple suppliers are connected via Internet and extranets. They use a simulation approach where the two e-MRO models outperform the traditional MRO on service level scores, and advocate e-MRO based on "collaborative relationships between suppliers and companies where an intermediary or broker assumes supply and replenishment responsibilities to a group of companies often across different sectors".

4.2 Web-based ERP

ERP systems connected to the Internet can offer e-procurement functionality of all sorts, depending of modules available. The integration with the company's internal transaction handling opens opportunities for decision support in sourcing and buying. Essig and Arnold (2006) analyze the possibilities of electronic marketplaces for buyers from an information economics theoretical perspective. They point out there are two information deficits from a buyer's point of view: ex-ante and ex-post. Ex-ante has to do with what should be known to a buyer before the transaction is done, and can be partly mended by intensified information-seeking activities. Ex-post has to do with what happens after the transaction is done, and the buyer uncertainty is harder to minimize. Based on information economics by Darby and Karni (1973), the information concerning a purchase can be split into three "qualities":

- Search qualities (known before purchase)
- Experience qualities (known costlessly after purchase)
- Credence qualities (hard to measure even after purchase, involve an element of trust)

In the cases of experience and search qualities in ex-post information, the useful data mostly come out of the internal ERP systems. As a bank of supplier performance data, an ERP system can play a key role in developing sustainable customer / supplier relationships.

4.3 e-sourcing

The most common definition of sourcing is the process of identifying potential vendors, conducting negotiations with them, and then agreeing supply contracts with these vendors (Bartezzaghi* and Ronchi 2005; P&PC 2013). Different models are applied – some sourcing qualify suppliers for bidding in electronic reverse auctions, while others seek strategic partners for integrated supplies and recurring orders. Bartezzaghi* and Ronchi (2005) notes from their research into 24 case studies in Italian firms: "It is clear that suppliers do not like e-sourcing tools, auctions in particular, as they constrain their contractual power. The main critical points are related to reduction in margins and the termination of consolidated relationships." The
views upon e-sourcing and e-reverse auctioning in particular, are overall more nuanced. Still, there are indeed reported much tension in connection with electronic reverse auctioning.

4.4 e-tendering

Tendering is the process of making an offer, bid or proposal, or expressing interest in response to an invitation, request for quotation (RFQ), or request for tender. The tender may carry just small amounts of information, basically offered price, but may also describe a number of aspects of the offer linked to quality, delivery, security, risk, timeliness, et cetera.

To produce a tender is a task for the supplier often involving a number of staff with a variety of skills. From three case studies introducing e-tendering in the construction industry, Lou and Alshawi (2009) report "The case studies show that the tender process was not changed to embrace the power of technology, but rather technology was used as a tool to record and accelerate the communication process." The also note that organizations using e-tendering enjoy better efficiency, accuracy and productivity in their tendering activities. Thus, e-tendering seem to improve internal collaboration inside the supplier organization as well as streamlining the communication with the buying organization.

4.5 e-reverse auctioning

Web technology has made it possible for the various major players to establish their own market places where pre-qualified suppliers can submit their offers based on the procurement function’s specifications. Electronic procurement has opened up a suite of new tools for buying organizations. Since the mid-1990s, there have been companies providing computer systems for procurement auctions. Electronic reverse auctions (e-RA) are tools that have achieved a significant position in the computer services world market, and e-RA is probably the e-procurement tool creating the most dramatic changes to buyer/supplier relationships. Suppliers believe they will see more unwelcome prize pressure, while there are reports of large savings for the purchasing organizations. In Norway, e-RAs have been visible only to a small extent, but there are examples of electronic procurement systems based on auction models that did generate significant noise. When the Norwegian Mail Services used e-RA in the procurement process of new cars, there was loud criticism and (partly) a supplier boycott (Sivertsen 2006).

Studies indicate that when adopting electronic procurement auctions, one can expect savings in time, quality and money. Beall (2003) provide a thorough and widely cited study focused on cost savings. They report an average savings of 15%, error reduction between 30% and 90%, and that the procurement cycle can be shortened by up to 90%. In “Reverse auctions – grounded theory from the buyer and supplier perspective” Carter, Kaufmann et al. (2004) present the hypothesis that reverse auctions will be viewed more favourably by buyers than suppliers, and differences exist between buyer and supplier perceptions regarding the involvement of each party in ethical improprieties. Jap (2007) finds through analysis of 25 quasi experiments involving 125 suppliers that large prize drops (higher savings) through use of e-RAs have a "detrimental effect on the buyer-supplier relationship". Ray, Jenamani et al. (2011) support these findings, claiming that e-RAs degrade the buyer-supplier relationship and decreases the supplier's interest to participate in subsequent auctions.
We must assume that the rules of these marketplaces are initially designed in order to strengthen the purchaser’s power in the buyer-supplier relationship. This may easily be perceived as opportunistic behaviour by suppliers experiencing reduced margins and being played out against other suppliers in online e-RA events (Carter and Stevens 2007). The companies that market e-procurement systems, claim the systems are neutral and only improve / streamline the procurement processes. This view is probably not commonly shared by the supplier side. Bellantuono, Kersten et al. (2012) concluded, based on the results of laboratory experiments, that a supplier's objective outcome is affected by the exchange mechanism (e-procurement system), and decreases if auctions are adopted, regardless of the level of complexity, and they advice buyers of complex services/goods interested in enhancing the positive attitude with their counterpart, to adopt negotiations rather than auctions. But in the article "Do all suppliers dislike electronic reverse auctions?" Caniëls and van Raaij (2009) examine attitudes to e-RA’s of respondents in 32 countries, and they finally find at least a small group of suppliers that are actually positive. It is very interesting that they also find that the most important variable predicting supplier attitudes is nationality. They find support for the proposition that the more developed the economy of the supplier country, the more negative the supplier's opinion about e-RA's. Their findings may indicate that cultural differences play an important role in the way electronic reverse auctions are perceived and received. A favourable side of e-RA's seen from the supplier's side, is that they may provide a more transparent bidding process (Carter, Kaufmann et al. 2004; Caniëls and van Raaij 2009). The effect on relationships will depend on the extent to which buyers employ the auction as a price weapon, or whether it is primarily as a process improvement tool (Smart and Harrison 2003).

The buyers may also suspect opportunistic behaviour. Padhi and Mohapatra (2011) propose a process control chart method to detect collusion in governmental electronic reverse auctions. The forming of (illegal) cartells is a tempting move for suppliers experiencing deteriorating margins.

4.6 e-informing

"Unlike the previous forms, e-informing is a form of EP that is not directly associated with a step in the basic purchasing cycle-like contracting or ordering. E-informing is the process of gathering and distributing purchasing information both from and to internal and external parties using Internet technology" (de Boer, Harink et al. 2002). In order for suppliers to enhance order fulfillment performance, buyer and supplier have to share information (Ho, Tai et al. 2008). Kamath and Liker (1994) describe an example how Toyota early on shared its inventory and sales information with its suppliers. Toyota implemented the just in time (JIT) delivery strategy. When the company gave its suppliers access to this type of information, they could plan and coordinate their operations better, and Toyota could coordinate its inventory orders better to achieve the JIT targets.
5 Towards a framework

In an exploratory study of electronic reverse auctions impact on customer/supplier relationships, Amelinckx, Muylle et al. (2008) propose a conceptual model to capture more aspects of introducing electronic procurement:

They identify five initial conditions and three process-influencing factors as they determine the outcome of an e-RA. The outcome can be grouped into financial, operational and strategic results, including buyer-supplier relationships in this latter group. This model seems to apply rather well to the introduction of e-procurement in general, and the model may provide an overarching, conceptual point of departure for further research into the impact of e-procurement on buyer-supplier relationships. However, it is important to bear in mind that current buyer-supplier relationships always also depend on the history of the relationships (Ellram 1991).

As mentioned above, Essig and Arnold (2006) highlights the information deficit problems in procurement from a buyer's perspective. The relationship with the chosen supplier must be based on a combination of knowledge and trust. They observe that different e-procurement tools play distinguishable roles supporting the informations needs of procurement decitions.
Their procurement information model is presented in a matrix (slightly reorganized from their article):

<table>
<thead>
<tr>
<th>Search qualities</th>
<th>Experience qualities</th>
<th>Credence qualities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ex-ante</strong>&lt;br&gt;information seeking</td>
<td>e-sourcing&lt;br&gt;e-tendering&lt;br&gt;e-reverse auctioning&lt;br&gt;e-informing</td>
<td>e-sourcing&lt;br&gt;e-tendering&lt;br&gt;e-reverse auctioning&lt;br&gt;e-informing</td>
</tr>
<tr>
<td><strong>Ex-post</strong>&lt;br&gt;information validation</td>
<td>ERP</td>
<td>ERP&lt;br&gt;e-informing</td>
</tr>
</tbody>
</table>

"Experience and credence qualities cannot be examined before the purchase decision is made. As a consequence of uncertainty and imperfect markets, buyers must use information substitutes. An example is the ex-post validation information from a previous successful transaction with the supplier. Additionally, references from other customers can be accessed through the Internet." (Essig and Arnold 2006)

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![Figure 3: Essig and Arnold (2006) supply pyramid](image)

Looking at the e-procurement function as a whole, Wagner and Essig (2006) find that the impact of electronic commerce on supplier relationships may move the relationships towards deeper partnerships in the case of high-involvement procurement objects, where most organizations already emphasize long-term partnerships. When low-involvement procurement objects are involved, the picture is somewhat more complicated. The relationships may move towards a more adversarial status, but introduction of electronic catalogues may move relationships in the opposite direction.

From the above we can point out that buyer-supplier relationships are affected by which and how e-procurement tools are involved, and that there is an important axis formed by the character of the goods or services to be procured. In one end non-strategic purchases of commodities and MRO goods are placed, while strategic one-source components are to be found at the other end. Thus, a conceptual framework should consider the types of goods or, perhaps even better, the types of e-procurement systems to handle these.
Most tension is created by introduction of electronic reverse auction tools, but even these are not universally disliked by suppliers because they introduce transparency and leveled competition into some business environments. Efficiency and cost savings are important benefits buying organizations pursue when they introduce e-procurement, but expectations are not always met. In procurement and sourcing in particular, the information deficit can be narrowed by e-procurement tools, but credence qualities or trust are still important attributes to a buyer-supplier relationship. Several e-procurement tools enhance cooperation and integration with strategic suppliers, building long-term business relationships. However, there are much research to be done on the impact of e-procurement tools to B2B buyer-supplier relationships. In the next chapter a suggested consetptual framework for such research is briefly presented.

6 Suggested consetptual framework

The idea behind the suggested framework is that the information qualities are the basic motivation for the e-purchasing tools, which in turn influence the customer/supplier (buyer-supplier) relationship, characterized by the five attributes. The framework is based on the perception of a buyer-centered collection of e-purchasing software where our view is a one-to-many relationship between one customer organization and several, sometimes competing, suppliers. This can be seen as a subset of all B2B buyer-supplier relationships where e-purchasing tools are used. A supplier will in most cases supply more than one customer, and the e-purchasing systems may be controlled by 'neutral' third parties or by the suppliers themselves. The chosen framework perspective is still relevant for a huge part of industrial purchasing where the buying organizations are larger and have bigger financial muscles than their main suppliers.

A transaction, ex-ante and ex-post, depends on information with search, experience, and credence qualities. The e-purchasing tools facilitate information handling where these qualities must be reflected to decision makers and thus shape the buyer-supplier relationships.

A B2B buyer-supplier relationship can be characterized by five attributes:
- Long term – if it is intended to last for years, or is adverse
- Cooperativity – to what extent customer and supplier work together to bring forward the goods og services purchased
- Profitability – both parts in a relationship must see economical incentives to continue
- Transparency – to what degree buyer and supplier can see cost structures, selection procedures and other crucial information on each other's realms, not necessarily symmetrically
- Trust – the credence qualities of the relationship

These five attributes are derived by collecting and interpreting considerations the research authors are occupied with, done as a qualitative approach to suggest what to examine while impacts on buyer-supplier relationships are studied.
Figure 4: Conceptual framework of the impact of e-purchasing on industrial buyer-supplier relationships.

The long term relationships relate much to the status as strategic supplier and buying organizations' strive towards reducing the number of suppliers while keeping a closer relationship with those left. When it comes to commodities and MRO the relationships are usually more adverse. Cooperation integrates links in the supply chain, and makes components arrive and fit more precisely to production needs. Purchasing is in its nature inclined to bring costs down, and many e-procurement tools support this to an extent where suppliers are reacting adversely, because this is perceived as opportunistic behaviour, and challenges the suppliers' profit margins. While the suppliers can suspect opportunism, the customers can suspect collusion between suppliers. Keeping buying processes and books transparent, trust can be enhanced and B2B relationships be strengthened.

7 Conclusion

Electronic procurement has changed how industrial B2B relations between buyer and seller is shaped. The introduction of new electronic tools affects the power balance and ways selection and negotiations are conducted. There is no reason to believe that we are at the "end of the line" of changes to how we perform industrial purchasing. On the contrary, many organizations have only adopted e-procurement tools to some degree, and we must expect
there is still some mirroring going on – transfer of routines and system architecture from old system to new without changing the structure (Henderson and Clark 1990; Hanseth, Bygstad et al. 2012). The research literature reports of significant cost savings for purchasing organizations adopting aggressive e-procurement tools, in particular electronic reverse auctions. This has caused some adversity among suppliers, which can be seen as a negative side-effect – experienced reflexivity (Hanset, Jacucci et al. 2006) that has caused a boomerang-effect deteriorating the buyer-supplier relationships. Another not so common side-effect is some suppliers' positive experience of e-RA's as a level playfield providing a transparent selection process in countries where there is a transparency deficit in the business culture. The business trend towards fewer, more strategic suppliers is supported by e-procurement tools that enhance the integration and cooperation between customer organizations and their most important suppliers.

On this basis a conceptual framework is proposed for studying the impact of electronic procurement on industrial buyer-supplier relationships. The three information qualities - search qualities, experience qualities, and credence qualities – are reflected in the way e-procurement tools are shaped. The five attributes of a buyer-supplier relationship – long term, cooperativity, profitability, transparency, and trust – are affected by how the different e-procurement tools are designed and utilized. This conceptual framework may be used as a lens for further studies of these phenomena.
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Enhancing Application Developers’ Generative Capacity on Mobile Application Platforms: A Research Agenda

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Abstract. Mobile application platforms are a type of generative platforms through which heterogeneous third-party developers can develop and distribute applications to users of mobile devices. The challenge of orchestrating the platforms with regard to the conflict between applying control and yet keeping the platforms generative has attracted the attention of IS research community. This paper provides an overview of the existing literature and proposes a research agenda that considers more focus on enhancing the generative capacity of the application developers through platform orchestration. It suggests that in order to be able to enhance the developers’ generative capacity, it is essential to get an insight into the motivations of developers as the initiators of their activity on the platform, as well as the process they go through from identifying an opportunity for developing a specific application to, to evaluating it, and finally, to exploiting it.

Keywords: generativity, generative capacity, mobile platforms, third-party development, motivation, control, orchestration.

1 Introduction

During recent years, the generativity of digital technologies has gained an increased attention from IS researchers (e.g. see [1][6][18][21][24][25]). Generativity has been defined as the “overall capacity to produce unprompted change driven by large, varied and uncoordinated audiences” [24, 1980].

One case of the applicability of a generative technology is the mobile service platforms. Platform refers to the digital infrastructure and set of rules [5] that provide the basis for new mobile service innovation [20]. With the launch of open mobile platforms, a large number of application developers have been able to access to the platform resources for application development [25]. Consequently, mobile operators, who for long had the gatekeeper control on mobile services, lost part of their controlling power [10] against platform providers.

The open platforms have helped in evolution of the so-called application economy (i.e. economic activities related to creation, management and distribution of mobile applications) estimated to reach US 100 billion dollars by 2015 [14]. The application platforms are based on mobile phone operating systems (e.g. Apple’s iOS, Google’s
Android, or Nokia-Microsoft Windows) and have a global reach to users. Developed applications are distributed to the users of the mobile devices via different platforms depending on the operating system as allowed by the platform provider (e.g. Apple, Google, or Nokia-Microsoft).

The platform providers offer the opportunity and the tools for third-party developers to create content and application, and work on a revenue-sharing business model with developers. Therefore, the platform provider, the developers, and other actors (such as device manufactures, mobile operators, etc.) shape global networks with the aim of providing mobile services to users [20]. Orchestration of these networks is done by the platform provider, facing it to the challenge of a finding balance between controlling the platform while keeping it generative ([9], [6]).

Moreover, a new challenge that these networks are facing is the crowded application markets on successful platforms. An application needs to be discovered among hundreds of thousands of other applications. This has caused concern for both application developers and platform providers, alike. The application developers are concerned about the monetizing issues, while the platform providers worry about losing the platform’s attractiveness to new developers and the consequent diminished positive network effects. A recent report [17] shows that in the US, only 2 percent of the top publishers on Apple App Store and 3 percent on Google Play are new comers. The crowded markets have a negative effect on innovativeness of developers as well [4] which in long run can reduce the value of platforms in the eye of users, due to its possible effect on reducing the variety of applications [9].

To boost the innovative output of developers, platforms should be designed in a way to enhance the generative capacity of the developers [1]. Generative capacity refers to “one’s ability to produce something ingenious and at least novel in a particular context” and works as the root cause of creative work [1, 345]. Despite the similar terminology, generative capacity should not be confused with generativity of a technology. Generativity of a technology is an output of its design, and enables the users to make unprompted changes on it; while generative capacity involves human agency, meaning that it is an attribute related to people.

Following the ideas outlined by Avital and Te’eni [1], this paper is based on the assumption that in order to fully utilize the generativity of a platform and have creative outputs (applications), having a generative design for the platform alone is not enough and should be accompanied with proper orchestration of its associated network of third-party developers. The paper suggests that it is necessary to study the third-party developers as individuals with different motivations and thinking processes in following the opportunity that the platform provides for developing and distributing applications. By studying the process that developers go through, it is possible to discover the ways through which their generative capacity can be enhanced by the orchestration strategies and control points that of the platform provider can apply.
2 Generativity

Generativity of a technology is about its ability to permit users to make unprompted changes to the technology [24]. Thus a generative technology is dynamic and allows for adding of new capabilities after its production [21] and co-creation of contents, services and applications by various types of actors [18]. Accordingly, a digital technology can be considered generative when being built on the notion of incompleteness and availability of room for creation of new uses and contents by individuals and firms [23]. A good example of a generative technology is the PC where the separation of software and hardware on it enables creation of new software applications by a broad audience without the requirement for hardware change.

The generativity of a digital technology is enhanced by four characteristics: capacity for leverage value creation and making jobs easier; adaptability to be slightly modified by users for broader use; ease of mastery by a broad audience; and accessibility to people to use the technology and master it [24]. Accordingly, the PC example represents a highly generative platform. People can easily access PCs and write software application for them (accessibility), can perform tasks such as fast calculation (capacity for leverage) without requiring a highly professional computer expertise (ease of mastery), and the PC allows for several purpose usage such as calculation, multimedia playing, internet browsing, and so on (adaptability).

Generativity of a digital technology can convey both positive and negative impacts for the users, or in a broader sense, for stakeholders related to the platform. For instance, PC users can benefit from generativity of a PC platform due to having the possibility to install various types of third-party developed software applications on their PCs, yet they face the risk of having their systems infected by third-party developed viruses as well. Meanwhile, anti-virus developer firms benefit from this threat and take the opportunity to make money out of the need of users for protection against viruses.

One case of usage of a generative technology is the digital platforms for mobile services. These platforms are built in a way that allow for the creation of content by application developers.

3 Mobile Application Platforms

Mobile application platforms are digital infrastructures that connect various groups of actors, and allow the development and distribution of applications from developers to mobile users. The actors include mobile users, mobile application and content providers, platform providers, advertisers, etc. Current mobile application platforms are designed on top of mobile operating systems (e.g. Apple’s iOS, Google’s Android, or Nokia-Microsoft’s Windows phone) by the operating system providers. A developed application on a platform can be distributed to the users of the mobile devices on that operating system (or platform).

Historically, mobile application platforms became popular through the initiation of Apple in launching its App Store in July 2008. App Store was an application store through which iOS-based device (iPhone, iPod) users could download third-party
applications directly to their devices. Apple could attract third-party developers to its platform through a revenue sharing model. Soon after, other large software companies and mobile manufacturers started building their application stores (or app stores) on their own or in partnerships. Such initiatives included the launch of Android Market by Google in August 2008, BlackBerry App World by Research in Motion (RIM) in April 2009, Ovi Store by Nokia for Symbian-based phones in May 2009, and Windows Phone store by Nokia-Microsoft following their newly established partnership in 2011.

Mobile application platforms and the actors shape global networks representing an ecosystem. In such ecosystems, the actors compete, cooperate, and coevolve, aiming for survival both independently and as a whole [13].

The platform provider has a central role in the ecosystem and imposes control [9] on the interactions of the actors with the platform. Four types of control are defined [10]: full-integration, portal integration, device integration, and no integration. In full-integration, the platform provider has strict control over device manufacturing, application development, and application store (e.g. Apple, or Nokia-Microsoft). In platform integration approach, the platform provider concentrates on the application development and application store without control on the devices (e.g. Google). However, Google demands some minimum requirements for the entering devices to its application ecosystem. In device integration approach, the platform provider manufactures the devices but is not providing the app store (e.g. RIM in 2011). In no integration approach, the focus is only on providing the app store (e.g. Amazon).

For the ecosystem to work in a generative way resulting in creation of innovative applications, there is a need for a technologically generative platform as well as the generative strategies of the platform provider in orchestration of the ecosystem. The next two sub-sections address these issues.

3.1 Generativity Enablement by Technological Design

The notions of digitizing and digitalization have been the enablers of the generativity of digital technologies [22]. By digitizing analog signals are converted into digital ones [18] through which various digital content can be built on top of hardware technology without the need for change of the technology. For instance, both photos and movies can be shot and stored by a digital camera, while prior to digitalization different kinds of cameras were used for photo taking and movie shooting. Digitalizing is about applying the digitizing techniques to the infrastructure in the society to create digital ones [18] such as a digital camera or a PC.

Digitizing and digitalization have resulted in the design of layered modular architecture in which the four layers of devices, networks, services and contents are loosely coupled and the innovation is allowed to happen at any level to create a new “kind” of usage [22]. For instance, in the case of mobile phones, third-party developers have been able to develop a “torch” application on top of mobile platforms (e.g. Apple’s iOS or Google’s Android) because the platform provider allows the required access level to a device and platform source codes. By installing this application on a smartphone, the device can be used as a source of light in dark; hence a new kind of usage was created for the device.
The technological design of mobile application platforms provides a layered modular format that allows generativity. However, the utilization of the generativity by third-party developers is facilitated by the platform provider through its orchestration policies and strategies, which are explained in the next section.

3.2 Generativity Enablement by Platform Provider Orchestration

The platform provider tries to engage third-party developers to the platform via boundary resources and maintain the platform user value through existence of a variety of applications for download [9]. Boundary resources are “the software tools and regulations that serve as the interface for the arm’s length relationship between the platform owner and the application developers” [8, 174] and include both technical (e.g. SDK, API) and non-technical (agreements) aspects. For example, Apple and Google each have created a successful ecosystem around their iOS and Android platforms by attracting thousands of third-party developers who use the offered SDK and APIs to create various types of mobile applications and content. These developers are simultaneously both compete to make their applications distinguishable among the others, and yet support each other through developers’ forums. Apple and Google as the platform providers, along with their developers, aim for success of the ecosystem, however, conflict of interest can happen among them.

As a result of this conflict of interest, a platform provider needs to find a balance between controlling the platform while keeping it generative. The aim is to allow the heterogeneous actors to be innovative in value-creation on the platform. Too much control can drive out the third-party developers and lack of control can make the platform fragmented and less useful for users [21].

The process of balancing the control and generativity in the context of mobile platforms has been studied from different perspectives: 1) high level strategies taken by platform provider when the conflict happens [6]; 2) using boundary resources by the platform provider [8]; the interplay of control, platform openness, and generativity [15].

On a high level, a mobile platform provider (Apple in the Elaluf-Calderwood et al. study) tends to “accept” the existence of the conflict and/or “synthesize” the conflict to find a common base with the other parties to resolve the conflict. For instance, in the case of Apple-Adobe conflict, when the use of Flash (multimedia system for producing graphics, animation, and interactive content on webpages) was prohibited on App Store, Apple was at first ignoring the tendency of Adobe to offer Flash content and brought excuses such as security issues (Acceptance of the conflict). Later it allowed the existence of Flash content (Synthesis) and made the use of Adobe tools possible for development, but then put restriction on the use of such tools again. However, later under the pressure from developers, Apple allowed the use of Adobe tools again. [6]

The high level strategies mentioned above are in line with the interplay between resourcing and securing with boundary recourses, as discussed by Ghazawneh & Henfridsson [8]. While resourcing, the platform provider extends the scope and diversity of the platform by providing additional ease and support, such as easing the restrictions for third-party developers to help them develop applications in new areas
(e.g. allowing the use of Adobe tools by Apple). Meanwhile, through securing, the platform provider controls the platform against applications and activities that can infringe the platform. For instance, it applies new rules and regulations, or tightens the existing ones (e.g. restricting Adobe tools by Apple). Resourcing can be done by the developers, too (referred to as self-resourcing). Self-resourcing happens as a response from developers to heavy securing of the platform provider. The case of “jail-breaking” is an example of self-resourcing, where developers were enabling themselves to run third-party applications on iPhone when the platform was closed to third-party development. Enforced by jailbreaking, Apple decided to open up its platform for third-party development.

Control and generativity do not always have a negative effect on each other, that is, the increase of one does not necessarily decrease the other and vice versa. A study [15] on the cases of Apple App Store and Google Play shows that when the control considers providing the standards and guidelines by the platform provider, it can strengthen the generativity of the platform. On the other hand, when the control considers issues such as permission requirement (for instance for distributing the application) it can hinder generativity.

4 Mobile Platforms and Third-Party Developers

Third-party developers are the critical drivers of innovation in the ecosystems shaped around the mobile platforms [11,126]. They use the platform to distribute their applications to the existing user mass. On the other hand, the platform provider needs to stimulate the innovativeness of third-party developers to enhance the value of its platform by more varieties of applications [4].

The developed applications are the creative outputs of the utilization of developers’ generative capacity. Generative capacity refers to an individual’s capacity to create something new in a given context [1], and works as the root cause of creativity. As mentioned earlier, generative capacity relates to an individual and should not be confused with generativity in the context of technology. Therefore, stimulating this capacity to deliver creative output requires the understanding of the third-party developers as humans.

Some scholars have studied the third-party developers in the mobile platform context to understand their challenges in working with the platforms either from a business [10] or the human agency [2][3] perspective. A study on the trends in the application market [10], considers the strategic changes in the market related to developers, and shows how application market trends can affect the application developers by, for instance, easier access to consumers, lower development costs, more job opportunities, etc. Another study [4], providing a more individual level analysis, gives an overview of the demography of developers on Google’s Android and Apple’s iOS platforms, and delivers an initial insight into developers’ motivations for development and choosing a specific platform. Based on a study of 47 developers in US, UK and Sweden, it categorizes the developers into four groups with regard to their attitudes: 1) believers (i.e. those who strongly believe in open source and sharing), 2) Pragmatists (i.e. those who focus on practicalities of revenue making and
application distribution facility), 3) cheapskates (i.e. those who have development as a side activity and have lower demand for profit making), and 4) centipedes (i.e. those who tend not to miss out any revenue making opportunity). The study concludes that although the structure of case companies’ platforms are different, there seems to be a loose connection between developers’ profiles and the platforms. Yet, since the two platforms are on different stages of maturity (with a Apple being mature and Android at its youth) it is hard to generalize the findings.

Another study [3] involving 60 developers from the aforementioned countries, explored the challenges of developing on iOS and Android platforms based on the Mobile Application Development and Distribution (MADD) model. It shows the concern of developers with regards to transparency and consistency issues in the platforms. It also focuses on the attributes of the platforms, and discusses briefly about developers’ motivations on developing applications. However, the study has a descriptive exploratory structure and provides a brief insight into developers’ challenges on the specific platforms.

5 Agenda for Research

The design of a generative platform needs to support the creative work of third-party developers [1]. The success of a platform in the long run is associated with the existence of the varieties of applications on it, hence the involvement of heterogeneous third-party developers is crucial [4]. The design relates not only to the technological, structural and organizational design of the platform, but also to the mechanisms of the platform provider to enhance the creativity of the developers [1].

Since creativity is the fruit of generative capacity [1], to increase the creative output of developers, it is essential to understand the affecting factors on generative capacity. This requires familiarity with the thinking process of the third-party developers, since they identify the opportunity for developing an application, to their evaluation of the opportunity, to finally exploiting the opportunity and developing the application [16]. The opportunity here refers to the possibility of developing a specific application and distributing it to the mass of users on the platform. Understanding this process can be helpful in stimulating the generative capacity of developers via orchestration initiatives of the platform provider.

The actions of the third-party developers in utilizing the generativity of the platform, represent an entrepreneurial behavior (identifying and pursuing opportunities), according to their motivations [16]. Therefore, their motivations might have an impact on their behavior on the platform. For instance, developers who are active on a platform as a hobby might perform a different behavior than developers who have the platform as their main source of income. The different behaviors might be seen, for example, in their actions/reactions to platform policies and rules, and type of the application that they develop. Therefore, a possible research question can be:

Do the motivations of the developers working on different platforms and different type of apps differ? What are the factors on different platforms that contribute to higher levels of motivation?
The existing literature on motivational issues on platforms considers the open source environments and developers employed within organizations [3]. But the mobile platforms make a contextual difference with open source environment and organizations due to the existence of competition between developers to make their applications distinguishable and discovered. In fact, the role of developers has gone beyond mere programming and into marketing, sales, customer service, and so on. Understanding the motivational issues related to third-party developers can provide an insight into the ways for better orchestration of a platform, in order to support development of innovative applications. Therefore, a possible research questions to relate the motivation and the orchestration initiatives can be formulated as: how can the platform provider motivate the developers through its orchestration initiatives?

Moreover, understanding the process that developers go through in developing an application from the idea identification to the distribution, it is possible for the platform provider to set the control points in a way to increase the variety of applications and make the platform more valuable for users. Control points are the points in the system where management can be applied [7]. A research [4] shows that adding an application to a same category on a mobile platform can decrease the innovative desire of the developers in that category, while adding an application to a different category can increase the innovative desire of the different category developers on the platform. Therefore, managing the control points of the platform can have an impact on the innovation of developers. For instance, a platform provider may prevent the publishing of some application to the platform because of the existence of similar applications; or provide some incentives for differentiated applications to enhance the diversity of the applications. Therefore, another possible research question can be: How do developers identify and evaluate the ideas for their apps? Is there any difference with regard to the type of app (for instance, the purpose it serves or another dimension)?

6 Conclusion

The topic of generativity of platforms and its related research areas have been noticed by IS scholars (e.g. [18][21][22]). The generativity of mobile platforms has created global networks (or ecosystems) of actors who gather around a mobile platform to deliver content to users. The third-party developers create the bulk of these networks, and the platform provider needs to orchestrate the system with the aim of increasing the developers’ participation and supporting their innovativeness. Current research on such platforms mostly involves the orchestration from the platform provider’s perspective and the issue of how to balance the control and generativity of the platforms on a strategic level.

However, little attention has been paid to the third-party developers as individuals in order to increase their creative output to the platforms in the form of developing innovative applications. This concern is topical due to the crowded application platforms, and its possible effect on less desire of new developers to join such platforms.
This paper aims to draw the attention of the IS research community to the need to find a balance between generative capacity of the third-party developers with generativity of the platform through orchestration initiatives. In order to do so, it suggests the need to learn about the motivations of developers as the initiator of their participation to the platforms, and their development process from identifying an application idea, to evaluating it, to develop it. Answering to the proposed research questions can open up a new horizon towards more effective orchestration of platforms with consideration of human-behavioral issues in order to enhance the generative capacity of developers, and further, their creative outputs.

References

Co-Creation in a Boundary Practice: Lessons Learned from an Engaged Scholarship Approach

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Abstract. In this article, Engaged Scholarship is disentangled from a co-creation and boundary practice perspective. The focus is on the attached inside researcher in collaborative basic research and action research project. Within the information systems discipline the intersection between collaborative basic research and action research is not that well explored. An extra interest has been on the transformation of descriptions to proposed actions that takes place in this intersection. From our empirical findings of an Engaged Scholarship project we have identified four lessons learned that could be used as considerations and proposed actions for the attached inside researcher. The lessons learned are derived from four theoretical themes: co-creation, dialogue, boundary practice and boundary objects. The empirical data presented in the article is from a project called Free2Ride, which was a co-creation project between researchers, ICT-developers and members from two equestrian clubs.

Keywords: Engaged Scholarship, boundary practice, co-creation, dialogue, boundary objects

1 Introduction

In recent years, the Engaged Scholarship approach [1] has started to receive more attention in the field of Information Systems [2, 3], for instance, having a special track in ICIS (International Conference on Information Systems) for the last three years; ICIS 2010 [4], ICIS 2011 [5] and ICIS 2012 [6].

Engaged Scholarship is primarily concerned with how academic researchers can engage with practitioners, in ways that somehow meet their often diverse needs [1]. Van de Ven (2007, p.9) defines Engaged Scholarship as a “participative form of research for obtaining the different perspectives of key stakeholders (researchers, users, clients, sponsors and practitioners) in studying complex problems”. Van de Ven (2007) describes four different forms of Engaged Scholarship: informed basic research, design/evaluation research, collaborative basic research and action research. In the above mentioned ICIS special tracks on Engaged Scholarship, the majority of the papers have addressed action research and/or design research.
This paper will instead focus on the last two forms of Engaged Scholarship (Figure 1); collaborative basic research and action research as well as the intersection between these two forms. In these two forms of Engaged Scholarship the researcher is described as an attached insider [1]. The concept of an attached insider will be explored and described from the analytical lens of co-creation [7] and boundary practice [8] with the research question: What are the challenges and opportunities during co-creation as an attached insider in Engaged Scholarship? The aim of the paper is to identify lessons learned and proposed actions for the inside researcher to follow during co-creation.

During our literature survey (Basket of eight and ICIS proceedings), researchers weren't able to find any articles with a focus on the intersection between collaborative basic research and action research. There are, however, several articles addressing action research [9-11], design research [6, 12, 13] and the intersection between design research and action research [14]. Additionally, there is one article in the Scandinavian Journal of Information Systems [3] that compares case studies with action research from the perspective of Engaged Scholarship.

We base our findings on the Free2Ride (F2R) project that was initiated by researchers from Halmstad Living Lab (HLL), ICT-developers (from Alpha Bluetooth Inc) and two equestrian clubs (LRF and HRF) during the autumn 2009 and F2R lasted for 13 months. One of the main ideas behind F2R was to develop an ICT-prototype based on wireless technologies that matched the needs of members of the equestrian clubs. F2R was carried out through an open and explorative approach during the early stages of the project. In particular, insightful conclusions can be drawn from F2R outlined as lessons learned. But in general, we can see a need for disentangling the concept of Engaged Scholarship and the role and characteristics of an attached inside researcher in such projects.

This paper will be structured in the following way: first the Engaged Scholarship will be described in more detail; secondly, the theoretical lens of co-creation in a boundary practice will be presented. In the third section the research approach will be discussed. In the research approach section in F2R will be described (from where the empirical data being used is derived from) together with the data gathering and analysis. Thereafter, the empirical data will be presented followed by a discussion. In the last section, conclusion, the lessons learned will be proposed.

2 Related research – Engaged Scholarship

The research approaches that stress collaboration with industries are conceptually and methodologically framed using a variety of terms such as: action research [9, 15, 16], collaborative research [17] and Engaged Scholarship [1, 2].

Engaged Scholarship is primarily concerned with how academic researchers can engage with practitioners in ways that somehow meet their often diverse needs. As mentioned in the introduction, Engaged Scholarship is about studying complex problems where the perspectives of different stakeholders are important. Engagement in the research is described as a process that involves “negotiation and collaboration between researchers and practitioners in a learning community; such a community
jointly produces knowledge that can both advance the scientific enterprise and enlighten a community of practitioners” (Van de Ven 2007, Page 7).

Four different forms of Engaged Scholarship are identified (Figure 1): informed basic research, design/evaluation research, collaborative basic research and action research. These last two forms of Engaged Scholarship; collaborative basic research and action research, are examples where the researcher has the attached insider perspective (being involved) and takes part in the activities alongside with the different stakeholders. The attached insider researcher develops context-specific knowledge that can guide action by dealing with the complexity of the problem. Therefore, exploring the intersection between collaborative basic research and action research is about understanding the transformation from descriptions into proposed actions.

In all four forms of Engaged Scholarship, the participants are involved in activities such as: problem formulation (situate and ground relevant problems), theory building (Engage knowledge experts in relevant disciplines), research design (Variance or process model) and problem solving (Engage intended audience to reach an impact). It is important to notice that, the focus should be on the client’s issues rather than involving the client in the researcher’s issues.

In this study, the researchers adopted an inside perspective (action research and collaborative basic research) and were engaged with, rather than for, the practice. This relationship makes Van de Ven's The Insider Perspective (2007) a natural choice for framing the research reported in this article. There are two main reasons behind the choice: (i) we jointly share activities to produce basic knowledge about a problem (CBR) (ii) we seek consensus on the proposed solutions regarding the expressed problems (AR).
3 Co-Creation In a Boundary Practice

The analytical lens adopted in this paper stems from the situated nature of practices [18], a practice that takes place during co-creation [19] in a boundary practice. Co-creation is an active, creative and social process, based on collaboration between firms and end-users [19]. It typically takes place in initiatives of innovation and research and development projects (e.g. a living lab projects where an ICT prototype will be developed in a user-driven innovation approach such as the F2R project). Furthermore, co-creation is a complex process with many layers including governance, knowledge sharing, complementary capabilities and assets [20]. In co-creation, dialogue between stakeholders is often forwarded as a key challenge e.g. [20, 21]. From the perspective of the producing company dialogue means not only listening to the customers; it means interaction, communication, engagement between two equally empowered problem solvers [22]. Dialogue then becomes the capacity of stakeholder groups to suspend assumptions and enter into a genuine “thinking together” mode [23]. Consequently, dialogue can help organizations to understand the complex nature of the customers’ social and cultural contexts [7]. There are three prerequisites for a dialogue: participants must examine their assumptions; the participants are regarded as colleagues and last there must be a facilitator to pull strings during the meeting. In co-creation, members of different communities engage in collaboration and meaning making in an inter-community practice (e.g. a Boundary practice).

The concept of boundary practices [8] is a practice that provides an on-going forum for mutual engagement between different communities of practice. A community of practice (CoP) is a group of people that share a concern (or a set of problems) and gain a deeper knowledge by interacting together on an on-going basis [24]. The members of a CoP find value in their interaction, spending time discussing their situations and needs in order to accumulate knowledge and learn about their community.

The purpose of the boundary practice is to maintain connections between several CoPs [25]. The inter-community practice, such as a boundary practice (Figure 2), is important [26] because it helps to overcome some of the problems a community creates for itself [27].

The connection between the boundary practice and the CoPs is created by members acting as boundary spanners/brokers and through their use of boundary objects (Figure 2). Wenger (1999) describes this as reification and participation. Participation is used to introduce elements from a practice into another by being a broker. Brokering [8] and boundary-spanning-in-practice [28] are both concepts aiming at relating practices in one field to practices in another by negotiating their meaning.
Fig 2. Boundary practices according to Wenger (1999)

The process of reification uses boundary objects (forms, documents, sketches etc) to interconnect CoPs. Such boundary objects are any objects that are relevant to the practices of multiple communities [27, 29, 30]. Levina and Vaast (2005) distinguish the difference between designated boundary objects and boundary objects-in-use; where a boundary objects-in-use has to be locally useful (incorporated into practices), meaningful and must have a common identity across fields. A crucial quality of boundary objects that facilitates sharing and coordination is their interpretive flexibility [30], which allows for multiple interpretations by the multiple parties utilizing them [31], for instance, during co-creation.

The concept of boundary practice neatly frames the challenges of a co-creation project where members from different CoPs join together in a new setting. Through focusing on translational activities, such as boundary spanning and the negotiations triggered by boundary objects, we can begin to understand the central challenges of Engaged Scholarship during co-creation in practice.

4 Research Approach

In our approach we applied two of the before mentioned forms of Engaged Scholarship [1, 2]; action research and collaborative basic research. Action research is very well described in the literature [9, 15, 16, 32, 33] as an intervention intended to treat a research problem and a practical problems at the same time. Collaborative basic research is described as creating basic context-specific knowledge that can guide action in dealing with the complexity of the problems [1]. Collaborative basic research has similarities with basic social science research [2], but it is unclear which forms social science research it is similar with. The research approach will be structured in three sub chapters: Describing the Free2Ride project, data gathering and data analysis – co-creation in a boundary perspective.

4.1 Describing the Free2Ride project

The Free2Ride (F2R) project was initiated by researchers from the Halmstad Living Lab (HLL), ICT-developers from Alpha Bluetooth Inc and two equestrian clubs (LRF
and HRF) during the Autumn 2009 and lasted for 13 months. One of the main ideas behind F2R was to develop an ICT-prototype based on wireless technologies that matched the needs of members of the equestrian clubs. F2R was carried out through an open and explorative approach during the early stages of the project.

The F2R project followed a structure of six phases conducted in an iterative manner (Figure 3) according to the principals of a living lab [34]: identifying needs and generating requirements, (re)design, developing conceptual prototypes, evaluating the design and prototypes (the design concept), developing the ICT demonstrator and evaluating the ICT demonstrator.

The first phase of F2R was to come up with new ideas, which were generated by members of the two equestrian clubs. The three most urgent areas according to the ideas related to safety during outdoor horse riding, communication during competitions and indoor equestrian training activities. In order to identify the most urgent area, a survey was distributed and used during different horse shows (show jumping, dressage, etc.). The prioritized area, according to the survey, was safety during outdoor horse riding.

![Fig 3: The F2R process model for innovation](image)

The second, third and fourth phases focused on creating and evaluating a design specification. Notable is that the design focused on a solution involving two units: a sender and a receiver. The first unit (a sender) should be attached to the horse's bridle and communicate through Bluetooth with a smart-phone application (the second unit) that is carried by the horse's rider (Figure 4).

In the fifth phase, the development of the sender followed the design specification and standard models from ICT developers. During the fifth phase the ICT-developers reported in a continuous manner, and progress was made visible to the equestrian clubs on the F2R website. The members from the equestrian clubs also had the opportunity to give feedback to the developers through the website.
Prior to the final phase, four pairs of prototypes (IT demonstrator and application) were developed and tested in their natural environment at the equestrian clubs. During this period a test person documented the testing on a blog, where the members could comment on the test. A list of suggested changes to both the application and the sender was compiled after the test period.

### 4.2 Data gathering: during and after Free2Ride

In F2R, the researchers were involved in the arrangements of various meetings and workshops. In particular, we concentrated on encouraging and supporting co-creation. F2R held (Table 1) 12 workshops with the members of the boundary practice (researchers, ICT developers and equestrian clubs as end users), five meetings between researchers and developers, four field visits at the equestrian clubs, on-line activities that lasted for three months, real life testing/evaluation of the ICT demonstrator and six follow-up interviews after the project. The workshops were recorded and notes were taken, which were also documented by photos. We also took field notes during the meetings and field studies. There were at least two researchers at every workshop or meeting that compared notes afterwards.

A typical workshop during F2R lasted for three hours and consisted of the following activities: a progress report (What has happened in the project since the last workshop), presenting the activities and goals of the workshop (How? Why? and What?), teamwork, presenting the result of the teamwork, summing up and the future.
Table 1: Summary data collection

<table>
<thead>
<tr>
<th>Data collection</th>
<th>Period</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field visits</td>
<td>Identifying needs and evaluation in figure 3</td>
<td>Understanding and documenting the activities that take place in the equestrian club</td>
</tr>
<tr>
<td>Meetings</td>
<td>In all the phases of figure 3</td>
<td>The meetings took place between the researchers and the ICT developer and were related to the progress of the project, such as deliverables, project documentation etc.</td>
</tr>
<tr>
<td>On-line activities</td>
<td>Evaluation and development in figure 3</td>
<td>Blogs, questionnaires, videos and news. All with the possibility to make comments was used during the evaluation</td>
</tr>
<tr>
<td>Workshops</td>
<td>In all the phases of figure 3</td>
<td>12 workshops where at least 15 people from two different communities of practice met and discussed needs and problems in relation to the project</td>
</tr>
<tr>
<td>Interviews</td>
<td>After F2R</td>
<td>Follow-up interviews focusing primarily on questions related to expectations in contrast to the actual outcomes but also covered questions in order to clarify different issues revealed in the analysis.</td>
</tr>
</tbody>
</table>

4.3 Data analysis – co-creation in a boundary perspective

The empirical data from the F2R project was analyzed in the framework of co-creation [7] and boundary practices [8, 25]. Some specific concepts such as boundary objects-in-use [28] and dialogue [21, 23] are related to exploring, understanding and describing a boundary practice.

Two episodes were identified from F2R, based on the criteria for inclusion, which requires an affect on all four dimensions of Van de Vens (2007) Engaged Scholarship diamond model (problem formulation, theory building, research design and problem solving). The two episodes (presented in the empirical data below) demonstrate how the members in the boundary practice are engaged in problem formulation and problem solving. The outcome of the first episode affected the research design (The researchers started to think of F2R as Co-creation, which is a process theory) and theory building (Relating Co-creation to our literature survey).

5 Empirical Result

These two selected episodes from the F2R project, the questionnaire episode and the video episode, match the earlier presented inclusion criteria.

5.1 The questionnaire episode

Just a couple of days before one of the workshops, an equestrian club member (Rachel) sent an e-mail to the researchers to inform them that she could not
participate in the upcoming workshop. At that workshop, the researchers had planned to present the results of a survey conducted at the equestrian clubs which aimed at prioritizing the needs of their members. Instead of participating in the workshop, Rachel developed her own questionnaire (inspired from the survey) and asked 48 of her pupils (Rachel worked as a teacher) to fill it out. Some of the questions were open-ended, while others were designed to choose one or several options from a multiple choice list.

The presentation of both surveys was made by the researchers at the workshop, during which there were naturally a lot of questions about the results. The results of the first survey were primarily presented as average values; medians or cross tables relating to specific questions in the presentation. All of the results indicated that F2R should prioritize safety aspects of outdoor horse riding. During the following discussion all the participants agreed that the focus should be on safety aspects.

The results of Rachel’s questionnaire were presented at the same workshop. As it turned out, Rachel’s survey complemented the first original survey, confirming and highlighting central aspects of the ICT-product to be developed. During the presentation of the Rachel’s questionnaire, the focus was set on the open-ended questions, one of which was, "Who is the buyer of this product?", to which one responder stated, “my mother” and another answered, “parents and relatives”, showing that the workshop participants recognized themselves in the answers, relating to discussions at home or at the equestrian clubs.

Another question in the survey was, "What functionality should be included in the ICT-product?" The responders could choose from a list of options as well as having the possibility to propose additional functionality. Ninety percent of the pupils marked both GPS-coordinates and separation alarms, and one of the responders wrote as a proposition, “a reset button to take care of false alarms.” This comment raised a discussion which led to the group quickly agreeing that the prototype in development should handle false alarms. A third question in the survey was, "Where should the ICT-product be attached to the horse?" Options included the bridle, the saddle, and the pupils also had the possibility to propose places to attach the ICT-product. Almost 100% of the respondents preferred the bridle as an option. One effect of this result was that a saddler became involved in constructing the bracket.

5.2 The questionnaire episode

During the last phase of the F2R project, evaluating the IT demonstrator, we used both a video and a blog to document the use of the smartphone application and the IT demonstrator in the real life environment of equestrian club activities. One of the video cameras was taken care of by an equestrian club member, Monica, who documented the use of the ICT-prototype and the smartphone-application during practice.

After a couple of weeks, Monica contacted the researchers and said she had made some recordings (Figure 5). In order to see the video we arranged transportation of the video camera and the actual movie. The researchers converted the video’s special CODEC to a format that could be edited on the laptop in order to make it viewable on the F2R website. The video was uploaded to the F2R website where
some of the other members of the equestrian clubs posted comments in response, but no comments were given by the ICT developers during the time between the workshops.

![Monica testing the prototype](image)

**Fig 5:** Monica testing the prototype

A decision was made by the researchers to show the video at the last workshop of the project. During the presentation of the video a lot of comments were not only made by equestrian club members, but also from the ICT-developers. There being three false alarms in the video led to a rather long discussion about the problem of false alarms (Figure 5). The distance between the horse rider and the horse is approximately one meter, and there is nothing that interferes with the Bluetooth signal between the smartphone and the IT demonstrator. It was decided that the ICT-prototype needed some further testing in a more controlled environment. During the workshop, after the video, the participants became involved in constructing a first version of a “to-do list”.

### 6 Discussion

In the empirical data, two episodes are presented. The two selected episodes meet the inclusion criteria presented in the research approach; the episodes should affect all four activities in Van de Ven's (2007) Engaged Scholarship research diamond (problem formulation, theory building, research design and problem solving). The discussion will be structured in relation to the important concepts presented earlier: boundary practice, co-creation, dialogue and boundary objects. The aim of the
discussion is to derive lessons learned as proposed actions for the attached inside researcher to follow during co-creation. After all, the attached insider is herself involved in co-creation in a boundary practice.

6.1 Co-Creation

Co-creation is described as an active, creative and social process, based on collaboration between firms and end-users [19]. In both episodes members from the ICT-developers collaborated with members of the equestrian clubs in exploring, understanding and describing the different problems in the innovation process. One of the challenges in co-creation is the dialogue [20, 21]. Dialogue means not only listening to the customers; it means interaction, communication and engagement between two equally empowered problem solvers [22]. If we examine the two episodes regarding interaction, communication and engagement during the presentations, the episodes could be regarded as examples of a dialogue. The members from the equestrian clubs are experts on horse riding, the ICT-developers are experts on technical issues, while in the problem solving process the two groups are equally important. Rachel conducting her own survey with her pupils is an example of engagement in the co-creation. Rachel wanted to contribute to the problem solving. Thus, it is important to integrate the context specific knowledge from the various CoPs into the collaborative problem solving process. The researcher acted as a facilitator during that process.

| Lesson #1: The inside researcher should act as a facilitator during collaborative problem solving in co-creation |

6.2 Dialogue

One of the cornerstones in co-creation is the dialogue [21, 22]. In the literature there are three prerequisites for a dialogue [23]; participants must examine their assumptions, the participants are regarded as colleagues and lastly there must be a facilitator to pull strings during the meeting. In the questionnaire episode, it was obvious that the equestrian club members examined their assumptions and regarded the researcher and ICT-developers as colleagues when it came time to problem solve. In the video episode, during the presentation of the video which described false alarms during horse riding, the ICT-developers were surprised that there was so many false alarms. They needed help from researchers and equestrian club members to write down a “to-do” list with the most urgent errors. During both the questionnaire and video episodes, it was the researcher who presented the material, summarized what people had expressed during the meetings and asked follow up questions.

| Lesson #2: The inside researcher should consider emergent topics during the dialogue |
6.3 Boundary practice

A boundary practice is described as a practice that provides an on-going forum for mutual engagement between different communities of practice [8]. The boundary practice is important [26] because it helps to overcome some of the problems a community creates for itself [27]. Involved in the two episodes are three communities of practice (CoPs); equestrian club members, ICT-developers and researchers. All three of the CoPs have their problems which they address in the boundary practice as a forum for collaborative problem solving. They all engage in negotiation in the episodes that enhances the possibilities for exploring alternative solutions. In the questionnaire episode, the equestrian club member conducted her own survey, which in a sense means that she acted as a boundary-spanner-in-practice [28]. She related experiences from her CoP to the other involved CoPs in the boundary practice.

Lesson #3: The inside researcher should be permissive for alternative perspectives reaching a mutual understanding

6.4 Boundary objects

In the questionnaire episode, the results from the original survey, as well as the results from the member created questionnaire were both a central part of the meeting, as was the video clip during the video episode. All three of these are examples of a boundary object; an object that is relevant to the practices of multiple communities, but is used or viewed differently by each of them [27, 29, 30]. A boundary object should also facilitate sharing and coordination [30] which fits very well with the surveys and the video. We regard the surveys and the video not only as boundary objects, but as boundary objects-in-use [28] because they were locally useful and meaningful in the negotiation and they had a common identity across boundaries.

Lesson #4: The inside researcher should identify boundary objects and utilize them in co-creation

7 Conclusion

As outlined in the introduction, the aim of the paper was to identify lessons learned and proposed actions for an inside researcher in co-creation with the research question: What are the challenges and opportunities during co-creation as an attached insider in Engaged Scholarship? Our findings show that both collaborative basic research and action research are relevant. In order to bridge the gap between these two research directions, exploring and understanding is crucial in guiding the transformation from descriptions into proposed actions. From analyzing co-creation and theories relating to boundary practice, two characteristics are identified during this transformation; the use of boundary objects and the importance of dialogues.
As a result of the empirical data, we have proposed four lessons learned for the inside researcher in co-creation; this list is not exhaustive, but instead emerged from the F2R project. The proposed lessons learned have not yet been tested or evaluated in co-creation, therefore it is important to evaluate these lessons learned in practice during Engaged Scholarship research. Another contribution of our research is a description of Engaged Scholarship in practice during co-creation, which could lead to insights for the engaged researcher.

When we started F2R, our initial guiding theories came from user-centric innovation [35], participatory design [36] and open innovation [37]. During F2R we started to realize that the initial theories did not support the analysis (describing and understanding) of the empirical data. Instead, we started to search for theories relating to co-creation and boundary practice which supported our analysis of the empirical data. From this experience I would like to propose one last lesson learned: the knowledge contribution from the inside researcher may not be what it was initially planned for.

References


Understanding the Needs of Cardiac-patients
Towards E-health Services

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Abstract. Cardiac patient’s everyday life is affected ultimately as a result of a cardiovascular disease. In addition the cardiac patient’s care path might not always prepare the patient for challenges that they may encounter after discharge from care. E-health services can offer ways to ease their everyday lives. The purpose of this research was to explore the needs cardiac patients have for e-health services. The findings indicate that cardiac patients have multi-factorial needs for e-health services. The study revealed that the most critical needs in coping with everyday life are related to access to information, social support and self-care. In conclusion the availability of e-Health services should be informed clearly as part of care path, which should continue through post-operative period. It's also crucial to develop personalized e-health services to meet the needs of cardiac patients.

Keywords: Patient’s needs, cope-pilot, citizen, cardiac patient, e-health

1 Introduction

Cardiovascular diseases count as one of the most common causes of death and disability in the developed countries. Basically, a cardiovascular disease can be anything related to the heart that causes an anomaly in its functioning. It’s a broad term to describe a range of diseases that affect the heart such as coronary artery disease and arrhythmias. [1]

The disease affects a person’s life ultimately. One should undergo significant behavioral changes such as quit smoking, maintain or achieve a healthy weight, and control various health conditions, for instance high blood pressure, high cholesterol and diabetes. [1] E-health services offer ways of fighting these struggles cardiac patients face in their everyday lives by providing ways to ease their everyday living.

Patient-centeredness has been a common basis for health care for some time. As a result healthcare has been transformed and patients’ position has enhanced. [2] The underlying philosophy of patient-centeredness is that the patient should be seen as a person rather than a cluster of diseases [3]. In this paper the term citizen-centeredness is used, because it emphasizes the patient as an active actor of his or her own life and well-being and not merely as being a patient. By narrow definition citizen-centeredness means that services and resources are tailored to the actual service and resource needs of citizens [4, 5].
The importance of this study was derived from the fact that comprehensive studies concerning cardiac patient’s needs in relation to e-health are limited. The majority of studies have been focusing on specific needs such as information needs. Therefore there seems to be a lack of studies in the field.

Nevertheless, some studies have provided some level of comprehensiveness when it comes to cardiac patient’s perceived needs. Lui and Mackenzie [6] for example conducted a research were their purpose was to identify Chinese elderly patients’ perceptions of their rehabilitation needs. They identified five categories of needs: informational need, physical need, psychological need, social need and spiritual need. In addition, Yilmaz & Emirogly [7] assessed the needs of myocardial infection patients in Turkey. They discovered that patients expressed various informational needs and the need for maintaining continuity of care.

While these studies have focused mostly on rehabilitation period there is a need for a more comprehensive view, that is, identification of needs taking place on both pre- and post-operative periods of care. The purpose of this study was to identify the needs cardiac patients have towards e-health services, specifically focusing on pre- and post-operative periods. In this paper, focus is on cardiac patients, though the needs are most likely the same in different chronic patient groups.

The paper consists of six parts. In part one, the background and motives for the study are presented. Part two discusses the methodologies, data collection and analysis. The results are presented in part three. In part four, the discovered results are discussed with reflection to earlier studies. Part five concludes the paper and finally, part six recommends topics for further studies.

## Methods

Qualitative research approach was chosen as the needs of cardiac patients tend to be very personal and otherwise complex. Furthermore, this approach was chosen in order to get a deep understanding of these needs and their meanings. In order to succeed, participants were interviewed one-to-one in a naturalistic setting.

### 2.1 Participants and data collection

The study was conducted as part of Coper pilot project, which is part of a bigger EU-funded Pump project aimed at developing well-being services to citizens. Coper pilot project focuses on cardiac patients living in Turku municipality area, Western Finland.

All participants were recruited outside the hospital. The target group consisted of seven participants. Individuals were selected in random manners. Ages ranged from 60 to 88 years. The type of the cardiovascular disease was not of high importance, since the purpose was to study cardiac patients as one group in whole. Eligible participants were approached personally and both written and verbal consent obtained from those who agreed to participate in the study.
Data was collected using thematic interview method and themes were derived from the research question. These themes were: *needs and preferences, prior experiences with e-health services, benefits in daily life, use of e-services, challenges and motivation*. Participants were interviewed once and all interviews took place at their home except for one which took place at University facility. Interviews lasted from 45 to 100 minutes. Interviews were auto taped with participants consent and afterwards transcribed. Transcribed data accumulated up to 74 pages.

2.2 Analysis

After transcribing the interviews, the analysis was carried through. The analysis was carried out using an inductive content analysis method. Data was sifted, sorted and organized into categories [8]. Since the analysis method was an inductive approach, no information from earlier studies was integrated into data analysis. In addition, hermeneutic approach was also applied. Accompanying hermeneutic method with content analysis ensured that phenomenon under investigation was deeply and clearly understood.

The analysis proceeded as follows: First the transcripts were read carefully several times in order to get an overview of the data and identify initial themes. Then the data was entered into NVIVO analysis program and coded. A dictum and sentence were selected as units of analysis [9, 10]. After the first coding round the data was revisited and similarities and differences were sorted into themes and categories.

In order to ensure trustworthiness of findings, several approaches were implemented [11]. During the analysis interview transcripts were referred to consistently and characteristic quotes were used to support the credibility of findings.

3 Results

Participants conveyed different needs for e-health services. These needs were categorized into seven categories. Each of these categories will be presented individually with supporting quotations.

3.1 Need for information

Need for information was one of the most important themes discovered. This theme was further broken into *advisory, counseling and access to reliable information*. Participants wanted information about different states of pain, medication, symptoms, daily life and information related to recovery. In addition, participants hoped for an easy access to information. Furthermore, it was stated that it would be good to have information before going to the doctor and after discharge.

“*It would be a lot easier if one could only find information from the internet. Especially during the first month or so when you don’t feel like going anywhere*” (P1)

Moreover, the study indicated that participants yearned for information about various things. Many felt that they were not informed well about daily concerns.
Additionally, participants wanted information about pain and how to identify different states of pain. Participants also expressed the need for information about symptoms, drugs and recovery.

“I would have indeed wanted information about side effects of drugs, when it’s appropriate to take them and whether to take them with or without food.” (P7)

It is also possible that information was available at some level but one might have missed it due to the possible shock entailing from the knowledge about the disease. Studies have shown that lack of information has a negative impact on the quality of life [12, 13].

Advisory

Participants experienced that they had not been informed well prior to their care and after discharge. It appears that there were lack of advisory and counsel, for example information about life in general. One participant felt uncertainty about life after discharge. The participant argued that there was not enough guidance about how life was going to change, what was normal in daily life and was what not. Life after discharge was experienced as difficult. Studies have reported that hospital professionals occasionally overestimate the quality and the amount of information provided and underestimate patients’ needs for information [14, 15, and 16].

“There is this terrible uncertainty whether this is normal or not, that suddenly I don’t see well.” (P1)

The way participants experienced lack of advisory varied. Some felt that their doctor did not share enough information. Others felt that they did not get enough information about discharge and diet. Guidance was also experienced vague, that is, relevant information was not available. In addition, the time that the patients spent with their doctors was mostly limited. This indicates the presence of paternalism and lack of partnership, which assumes that doctor knows best, thus, making decisions on behalf of patients without involving them. Paternalism should have no place in modern health care [17], instead partnership should be embraced. Successful co-partnerships are those of non-hierarchical and where decision making and responsibility is shared between partners [17]. For this to happen, citizen-orientated approach should be applied.

“Well I tried to get as much information as possible from the doctors at the hospital but they didn’t know anything themselves” (P5)

Counseling

The participants expressed the need for counseling because for example request of results via the phone was considered difficult. Furthermore, participants emphasized the need for making appointments and contacting the doctor online.

“And then making these appointments would be good” (P5)

The interviews indicated that participants wanted to be in touch with their doctors via email or other means of communication. The use of the phone was experienced difficult. It was generally desired that results could be requested via other means and the possibility to leave a call request.
“Then there is this communication channel with doctors. It doesn’t exist at the moment so it would be a good one” (P4)

Apprehensible and reliable information

Majority of participants agreed that medical documents are impalpable. They found medical terminology difficult to understand and doctors’ speeches hard to comprehend since they spoke ambiguously. Doctors used the language that a common person might not understand. In addition, the information on the internet was generally found difficult to comprehend. This is major barrier for empowerment, thus, preventing patient-centeredness from taking place.

“Oh those abbreviations. You just cannot understand them. What was that SSV-type block?” (P4)

Finding reliable information was experienced challenging. There is a lot of information on the Internet, but distinguishing reliable and relevant information from the mass is challenging for many. The reliability of the information on the Internet was affected by the fact that there was no guarantee of the originality of the writings since anyone could post writings at any time. For example there is no assurance of reliability of the information found from discussion boards.

“It’s pretty ambiguous. Some people talk of one thing and other people talk of another thing.” (P4)

Generally speaking participants experienced that locating health information was difficult. The analysis indicated that there is a need for such information that can be found easily.

“A place where information can be found easily would be good. I did not find good information about reflux diseases. There was lots of information about reflux diseases in general but nothing specific to fit my needs.” (P2)

3.2 Communication

The study revealed that there is a need for communication. The participants had experienced difficulties related to communication. Many experienced that they were not given a chance to participate in their care. They felt that they were underdogs and outsiders in their treatment. While paternalistic behavior can be benevolent and well intentioned, it does have an effect of creating and maintaining an unhealthy dependency towards health care professionals [17]. According to some participants, one reason for lack of communication was due to the fact that doctors changed continuously during their treatment. Participants felt that doctors did not see them holistically but objectified them. In addition, the study indicated that doctors were mostly arrogant and did not care for the patient. Sufficient and timely information is essential for proper self-management and compliance with medication to take place [18].

“So this is the experience I have had about doctors. They think that they are so much better than everyone else, so that they don’t have to listen to the patient” (P4)

The interviews revealed that there were other conflicts related to communication. For instance, some participants felt that their questions were not answered clearly.
One of the problems was that most doctors did not talk to their patients during their care. In addition, patients were not taken seriously.

“The problem with doctors is that they don’t talk at all. They’re always in a hurry.” (P6)

### 3.3 Well-being management

Participants expressed the need for the opportunity to follow their diet and embrace healthy lifestyles. Studies have shown that motivating goals and scope setting has a positive influence on quality of life [19, 20]. The results indicated that participants took care of their health and followed healthy lifestyles after discharge. For example, many quit smoking. Pischke et al. [21] study showed that lifestyle changes such as diet and exercise can have positive long-term effects on well-being of cardiac patients. Furthermore, support groups organized different kind of events related to food and sports. Those with medication stressed the importance of having a healthy diet. However, participants also expressed the need for guidelines related to diet since hospitals do not give enough guidance about this matter.

“Yeah, it would be fantastic to have written guidelines.” (P1)

### 3.4 Support

Studies show that impaired social support is one of the most robust health risk factors [22, 23]. Furthermore, high levels of social support have been found to improve the quality of life [24, 25] and self-care management [26]. Support was an important theme, though perceptions about it varied. For some, support from family was the most important. For others, support from the outside or personal support was better. Participants, however, all agreed that support is important. It does not matter whether it comes from the family or from outside. Family was considered the most important source of support. Mostly, it was a spouse or someone close. If it was not possible to get support from the family or peers support from the outside was also considered valuable. In this case, support would come from a neighbour or company doctor. Nevertheless most participants expressed interest towards having peer support. According to the interviews, peer support was generally seen to have facilitating effect.

“It doesn’t matter whether the help comes from an outsider or neighbor since the daily life is not shared” (P1)

### 3.5 Self-care

Self-care involves regular maintenance tasks such as managing multiple medications, engaging in physical activity and healthy diet follow-up [27]. The degree to which one actually performs aforementioned behaviors is determined by the level of confidence one expresses towards their self-care [26]. Participants showed interest towards time management, document management, medication management, monitoring and health management. Time management was important to many. This
included calendar and reminder features through which one could follow and plan tasks. It appeared that majority of participants had several follow up meetings with their doctors in a year. Since these meetings are rarely scheduled, remembering them can be challenging.

Cardiac patients have various documents and gradually with time the amount of these documents increases so much that keeping them in order becomes difficult. The documents can be for example medical records, prescriptions, X-rays etc. According to the participants it would be good if one could easily manage these documents. Documents should be in a logical order and in an electronic form.

“I would like to have all medical records in chronological order and in one location” (P5)

It appeared in the results that participants were at least on one medication and some might have been on more than one at the same time. According to the participants, a way of managing medications was welcomed. In addition, a reminder to take the medicine welcomed as well.

“One thing that I would like to have is this thing that reminds every three hours to take the pills. That is what I would like to have. I do place reminders myself but I never follow them. “(P6)

Monitoring was generally seen as a good and beneficial thing. Especially for those who live alone having a 24-hour service would be essential.

“Especially for those who live alone this kind of monitoring service would be extremely good. One would know where from to get help in case of an emergency.” (P7)

Having a chance to manage one’s health was considered important. Participants stated that following medicine doses is a lot easier on the computer than traditionally. Having a possibility to take measurements at home would save a lot of time. Since cardiac patients have to take measurement, it would be good if the data could be transferred automatically to the computer. Participants found this feature important.

“Yes it would be great. I could just measure and send it online. This would save time, I would assume.” (P6)

3.6 Social aspects

Social isolation is something to be taken seriously. Narrowly social isolation can be seen as a loss of place within one’s group. Other definitions include apartness or aloneness, which are often described as solitude. However, it seems that the concept has various definitions and distinctions dependent upon empirical research. [28] Social isolation can then lead to low quality of life. Studies have shown that impaired quality of life possesses the risk for re-hospitalizations and death [29].

Social aspects were considered important. Participants wanted to meet people with similar interests-people with whom to exchange feelings and ideas. Furthermore, the chance to get socially involved and to expand networks was welcomed.

Participants felt that it is a lot easier to talk with people who are in the same situation than with those who are not. It was generally agreed that people who do not
have heart related problems are afraid of getting involved with those with such sickness.

"Since I’m alone, it’ll be good to meet new people but this heart problem of mine kind of sets limits. There are many people who are afraid. I wish I could talk with people with similar sickness and experiences” (P1)

Getting involved socially was appreciated among participants. It was considered important especially for single person household and those with no family. As it was stated in the results, the threshold for getting involved in something new decreased if there was a friend involved.

“So there was two of us but she was not a pro either. The threshold to try something new like this dropped a lot. So it’s much easier to go if there is a friend involved” (P1)

It was mostly experienced that the sickness entails loneliness. This feeling grew for example at support group meetings because there were mostly couples in there. In addition, building new relationships was experienced difficult if you did not find people with similar interests. Despite the fact that support meetings constituted mostly of couples, it appeared that also couples would be interested in this kind of social aspect.

“Those with families and a spouse don’t need it that much but there were, however, lots of couples at the meetings so they are also interested” (P1)

3.7 Technological aspects

Ease of use and practicability

Technological aspects act as an important factor in acceptance of e-health services. More specifically, user’s perceptions of usefulness have been seen as the strongest determinant of acceptance. Nevertheless, ease of use is also seen as an important factor though not as important as usefulness. [30]

The results indicate that elderly people face difficulties when it comes to information retrieval. For this reason, counsel was mostly requested personally. Thus, it seems like elderly people indeed do need advisory in information retrieval as one respondent clarifies.

“Elderly people need advisory. I also need to really search for information about the meaning of something. For example it was written in my medical case summary that the patient is a little obese. ” (P2)

Participants highlighted the importance of ease of use and practicability in e-services. The importance of ease of use rises when the user group is the elderly people. Participants expressed the need for e-services that are easy to use. Navigation in the internet was difficult for many. Ease of use was mentioned as an important factor. For example, logging in should be clear and easy. The fear of using e-services would vanish if usage was simpler.

“It’s just that while navigating (on the internet) you might suddenly confront something completely different than what you were looking for. You'd be like, hey, this is not where I wanted to go.” (P1)
Practicability was seen as an important factor as well. What participants meant with practicability is that e-services need to have a clear meaning or purpose, and they should also be useful. They must support individuality. Participants wanted e-services that are personal. For example home directory was seen as a useful feature.

“If there was this kind of home directory where with one click, one click can check everything at once” (P1)

Continuity
Discontinuity of care is usually experienced in various ways. For some, it could mean the lack of adequate information or miscomprehension of the given information [31]. For others it could mean the lack of communication and coordination between different healthcare settings [32].

Participants stated that they had experienced issues with data transmission and visibility. The issues caused problems in continuity of care. In order for the care to successfully take place the data needs to be available and accessible when needed. It was usually, however, experienced that data was missing. The data was not transferred from one place to another and this was considered annoying and frustrating. In addition to lack of data availability, delays in data transmission made the participants feel uneasy.

“So I was transferred to another hospital and there were issues with data transmission because the data did not follow. So there were lots of interruptions.” (P1)

Cardiac patients have different kinds of documents such as medical records, x-rays and ultrasound photos which are usually in CD-format due to their large size. Information saved in CD-format might not be accessible in other places, for example other hospitals. Participants stated that this is frustrating as it appears in the following quote.

“So I’d take this CD that I have paid for and I’d go to the private sector or occupational health care and then they cannot access the CD. It’s just so stupid.” (P6)

Data security
Traditionally, policies have effectively been able to ensure the privacy of patients’ paper records. However, with e-health these policies have become obsolete. As personal medical information is being processed and transmitted electronically, possible threats to protection of individuals’ right to privacy are becoming evident [33]. In relation to data security, logging in was an issue experienced by participants. According to them large amount of passwords makes things difficult. Accessing the system was difficult. Participants felt that they had to memorize too many passwords because logging in requires in most cases several passwords. They wanted an easy and sure way of logging in. A card system or pass codes for online banking was considered a good option.
"You can’t lose or forget online banking pass codes, but this card system seems even much easier and it can be used by many people. Especially those with typical kind of diseases" (P1)

In addition to easy access, the participants stated that e-services should be reliable and secure. Most regarded advertisements on web pages as annoying. Services like Facebook were considered unreliable because they included many uncertainties such as payments.

"Of course those adverts on e-services are very annoying" (P5)

Availability
Participants agreed that there should be the possibility of sharing personal health information. The issue was, however, that lot of data was missing. This frustrated many. Most participants had to gather the missing information themselves and deliver it to the hospital. This was regarded frustrating. In addition to inconsistency of the data, participants experienced that there were errors in their patient information.

"The first one wrote ten mistakes in my medical documents. Everything was wrong. My age was ten years younger. I was made younger. I was deeply offended” (P6)

Many felt that medical information should be made available to family members. Sharing the information should be made possible so that family members have access to it. In other words medical information should be available to the patient.

"I think it’s also a good thing because I also would like to know clearly how my kids are doing” (P5)

4 Discussion

Earlier studies on people with heart problems and their needs for e-health services were not found. Instead, studies about needs related to care was found. In this study the focus was not on events taking place during the operational period rather than on pre- and post-operative periods.

Technological needs
Technological needs were related to availability and continuity. The results indicate that lack of access to information and time lags in communication were considered as complicating factors and the possibility to share personal health information was expressed. This is congruent to the results of Civan et al. study [34]. Their study indicated that users hoped for access to their personal information and the possibility to share their information with other people, namely doctors and family members.

Need for information
The results indicate a lack of information at many levels. This causes uncertainty and ignorance about general life and continuity of everyday life. Life after discharge was considered difficult because enough information and advisory was not given prior to discharge. Timmins & Kaliszer [35] categorized the types of information needs into
following categories: symptom management, lifestyle, anatomy and physiology, diet, psychological factors and physical activity. In this study, information need types were not categorized as precisely as Timmins & Kaliszer did. We can, however, concur to their conclusions since the results of this study could be applied to the one of Timmins’ and Kaliszer’s. Stewart et al. [36] studied the differences in information need between male and female coronary artery patients during the post seizure period. Their results indicated high need for information especially for female patients. In this study, differences between genders with respect to information needs were not studied since this was beyond the focus and purpose of this study.

In his study, Williams [37] discovered that participants experienced the quality as the biggest issue with the information found from the internet. Williams’s results are thus congruent with the results of this study.

The study conducted by Eysenbach et al. [38] showed that the quality of the information on the internet is a big problem. According to the study there were critical issues with the quality of the content such as accuracy. The root problem was discovered to be the large amount of available information. This was also discovered in our study. Participants felt that there is too much information in the internet, which makes finding the relevant information difficult.

Communication with health-care professionals
Tjora et al. [39] explored patients’ experiences of using means of communication located on the internet. Their study showed that patients felt that through internet it’s much easier to communicate with their doctor. The patients felt that using the phone as means of communication was difficult, since it’s relatively difficult to reach the doctor. In addition, Tjora et al. study indicates that this kind of means of communication was used to ask small and general questions. Similar experiences were discovered in our study.

Need for social support
The importance of social support rises after discharge, since confronting daily life can be challenging. According to the results, the source of support is not of high importance. Attitudes towards social support varied among participants. For some, the most important source of support was family such as a spouse. Since not everyone has a spouse, the importance of peer support became relevant. Most participants felt that peer support is important because one can exchange experiences and get relevant information.

Krumholz et al. [40] discovered in their study that the lack of emotional support is the biggest factor that affects the severity of post discharge seizure on cardiac patients. Emotional support, however, was not investigated in this study, but the results indicate that the amount of received social support does correlates to cardiac patient’s mood and motivation. Thus we can say that our results confirm the fact that social support has a positive influence on cardiac patient’s survival in post discharge everyday life.

Need for socialization
Socialization is especially important for those who live alone. Given a possibility to socialize, the feeling of being lonely disappears. This again has a positive influence on cardiac patient’s mood. Heo et al. [41] study suggests that taking part in family, friend or work related social events can enhance the quality of life, which this study also verifies.

Building new friendships was considered difficult, since according to participants it was difficult to find people with similar interests. In addition, building friendships is difficult because cardiac group meetings are mostly attended by couples. This leads to the situation where single people feel awkward to attend the meetings, and in worse cases the person might cease to attend the meetings altogether. This again increases the chances of exclusion. The experience of socialization varies. It is a subjective experience and for some people it can mean a lot while for others it’s only a small matter. Nevertheless, social aspect is very important as many need theories, such as Maslow’s [42], suggest.

**Self-management**

Previous researches about self-care have mostly been focusing on the disease and its management. In this study management of health related documents were included in addition to management of the disease.

Artinian et al. [43] conducted a study where they investigated behaviors related to self-care among cardiac patients. Their study indicated that the most common behaviors were related to management of medication and managing planned meetings with their doctor. The most uncommon behaviors were related to symptom management and tracking health. Categorization of behaviors was beyond this study’s scope. Otherwise the results are congruent with Artinian et al. study.

**Well-being management**

The findings indicate the need for well-being management. Other studies have also discovered that there is a correlation between healthy lifestyles and low cardiac arrest risks [44, 45]. Stamfer et al. [46] for example discovered in their study that for women who maintain healthy lifestyle, such as exercising, non-smoking and good diet can possibly decrease the risk for cardiac arrest with 83%.

5 **Conclusions and implications**

Cardiac patients have multifactorial needs. The need for e-health services is thus big. It is difficult to prioritize these needs since they are deep personal experiences. Hence, they should be handled individually in this respect. We can conclude that the most important needs are related to access to information, social support and self-care or self-management. The significance of access to information is due to its empowering and motivating aspects.

Access to information can enhance communication between patient and health care professional, for example, by raising health awareness, enhancing self-management and easing access to social support. In order for the patient to fully benefit from
provision of information, access to information should be made easy and reliable. This fact creates the need for personalized e-services. It is also important to highlight the importance of social support because its effect to psychosocial well-being is prominent, which again is extremely important for someone with a cardiac disease or other chronic disease for that matter. Without support there is a possibility that one will get depressed and face exclusion. This further deepens the existing digital divide. Self-care is important because of the fact that in most cases the cardiac patient is all alone at home after discharge. Monitoring and managing the heart condition involves many new tasks and failure to successfully manage the condition can result in difficulties in cardiac patients’ daily life.

In summary, cardiac patient’s needs appear as displayed in figure 1 below. In the figure we can see where different needs and corresponding e-health services are located. In addition, we can see how citizen-centeredness and patient-centredness takes place respectively.

![Fig. 1. Cardiac patient’s needs and e-health services](image)

As it appears in the figure, preoperative period is more focused on citizen-centeredness because the individual has not yet established a clinical relationship with a doctor and is thus purely a citizen. During this period the most important needs that need to be emphasized are those related to information and well-being management. Correspondingly, the most beneficial e-health services in this period are those which offer health information and lifestyle management services.

After the clinical period the patient has established a clinical relationship with the doctor. During postoperative period patient-centeredness comes along. In this period the need for information is prominent because life has changed and the citizen/patient must embrace new ways of dealing with daily life and managing their condition. Other important needs that appear in this period are needs related to socialization, well-being management, communication, self-care and social support. In addition, technological needs appear to be important in this period as well. E-health services
should be reliable, easy to use, practical and most importantly available. E-health services relevant to this period are: information services, mobile services, advisory services, management and self-care services.

As it appears in the figure, most needs and e-services appear in postoperative period. In this period it’s critical that services are available, otherwise cardiac patient’s needs are not met. The problem appears to be that demand and supply do not meet in this case. The problem could be that citizens are not aware of existing services while the need for such services is huge, hence, demand and supply do not meet. One solution to this dilemma could be developing personalized e-services. Services that support a particular disease universally, for example things related to a cardiac disease could be located at the same place, in which case the citizen will not have to go searching for the services.

6 Recommended topics for further study

One particular limitation of this study was that participants did not have much experience with e-health services and this meant that the research problem had to be approached from a general aspect. Thus, it would be good to conduct this research again with a more experienced focus group. This way we would gain a deeper understanding from cardiac patients’ context and have a better understanding of their needs for e-health services. Despite the limitation, this study revealed important insights to cardiac patients’ experiences and needs.

Another limitation of this study is that it focused on those living in Western Finland. Thus the results cannot be straightforwardly applied to other municipality areas in Finland or other countries since geographical factors may have a way of affecting how people perceive their needs.

Furthermore, this study was approached using qualitative research methodologies. The study could be repeated with quantitative approach. Using quantitative approach would enable having a larger focus group, hence, producing more generalizable results.

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Examining Sourcing Strategies in Information Systems Development in the Financial Sector

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Abstract. Having a close inspection on sourcing motives in the financial sector it is found that resources used in development of information systems (IS) are seen as an important factor for sustained competitive advantage. However, it can be claimed that it depends to a high extent on the application of different sourcing modes. From an investigation of four case organizations in the financial sector we analysed IS-sourcing projects and the motive for sourcing as well as if appropriate sourcing strategies were applied using the resource based view of the firm (RBV). Our study addresses the research question: How can motives for sourcing of IS-development in the financial sector be explained? The empirical findings revealed that the IS-sourcing model is implicitly applied in practice, and it can be concluded that the motives for IS-sourcing are driven by the analysis of internal resources and its potential being a source of competitive advantage.

Keywords: IS-sourcing, IS-development, Resource based view (RBV), VRIO framework, Sustained competitive advantage, Strategic value, Sourcing modes.

1 Introduction

The rapid and structural changes in the business environment of the financial sector due to the globalization of financial markets, technological innovations, and the growing importance of the Internet, increase the demand for a higher degree of flexibility in IS-development [1]. Although the strategic importance of IS in the financial sector may seem trivial, it is in fact crucial in the terms of today’s concern over a rapidly changing market. The strategic importance of IS-development applies abundantly to the financial industry which is characterized by a high degree of IT-supported business processes [2]. Indeed our own argument is that IS are of strategic importance and therefore carefully sourced using tailored strategies.

Gottschalk and Solli-Sæther [3] discuss an important point about the drive for the decision on how to source IS-development. They concede that outsourcing is a strategic decision made by organizations in order to compensate for lost internal resources. From this our research question is as follows: How can motives for sourcing of IS-development in the financial sector be explained?
The aim of our research is to analyze financial institutions’ motive for sourcing and what strategies that are applied. Consequently, the research targets the traditional financial sector rather than pure Internet based financial institution or private banking etc. We have consciously chosen to only include larger banks as these are more likely to do sourcing. Lacity et al. [5], shows evidence for this through the answer to the question of what type of firms that are more likely to outsource IT. The authors found that size matters, which supports our delimitation in the choice of large banks [5]. To summarize, the purpose of our research is to investigate if IS-sourcing can be seen as a strategic tool in the financial sector for gaining competitive advantage.

2 The Resource Based View and Sourcing Strategies

Sourcing decisions can be approached from different theoretical perspectives. The resource based view (RBV) and transaction cost theory (TCT) are considered as extremely influential in the field of outsourcing [6, 7]. Past sourcing decisions were often driven by cost where the company would outsource if gained benefit exceeds the transaction cost [3, 5].

In contrast to the TCT perspective, RBV includes the relational view arguing that combining the organization’s resources in a unique way holds a source of competitive advantage [7]. We are interested in approaching sourcing from the analysis of the internal resources and how sourcing strategies can be seen as an opportunity to access complementary capabilities to strengthen internal competitiveness.

According to RBV, a resource is considered to be a resource if it holds the potential to “exploit opportunities and/or neutralize threats in a firm’s environment” [8]. A valuable resource has to fulfil three further attributes in order to achieve sustained competitive advantage, namely rareness, imperfect imitability and non-substitutability [8]. Barney [8] states that an organization gains a competitive advantage only if the value-creating strategy is not copied by a considerable number of competitors. As the organization’s resources are the source of competitive advantage, it can be concluded that those should be kept or gained internally. The central issue of the RBV is accordingly the identification of such resources [9]. The resource based view can be applied to the analysis of the relationship between IT and sustained competitive advantage. “The concept of a firm’s resources and abilities are defined broadly, and could certainly include the ability of an organization to conceive, implement, and exploit valuable IT applications” [10].

2.1 Sourcing Strategies for IS-Development

IS-sourcing strategies is the delegation of all or any part of technical resources, human resources and management capabilities associated with providing IT-services to an external vendor [4]. The provision and use of IT-based products and services underlies general economic principles. First of all, organizations – facing the need for a product or service – have two distinct options, to make it on their own or to buy it.

However, the practice in IS-development goes beyond simple make-or-buy decision [4, 12]. For a further categorization IS-sourcing strategies can be classified in
strategies with complete internal production, control, and in strategies with some degree of external involvement. Depending on the definition of the term, the latter category can be denoted as outsourcing [13]. We follow the perception of De Looff [14] and define IS-outsourcing as follows: Outsourcing in the context of IS-development is defined as the act of shifting some or all of the IS-activities to be performed externally by contractual agreement.

**Insourcing**

Basically *insourcing* is the opposite of outsourcing, however, there is some confusion in the literature. First, the term could simply mean that the organization performs an activity internally, thereby using internal resources and governance. Accordingly, we define *insourcing* as the following: *Insourcing* is the opposite of outsourcing, i.e. the activity is governed and performed by internal resources. Here, staff augmentation through external resources is only implied in *insourcing* as long as it is driven by the need to increase staff capacity, rather than to replace lack of knowledge.

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<th>Table 1: Insourcing in accordance to the dimensions of sourcing</th>
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<td><strong>Dimension</strong></td>
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</table>

**Standardization of Commodities**

Taking the model of Roy and Aubert [15] as a starting point, this sourcing mode was denoted as recuperation. With this, Roy and Aubert [15] mean the strategy to collaborate with potential competitors in order to share the development cost for the IS. The *standardization of commodities* means, IS-functionality regarded as commodities are standardized to maximize the effect of the economies of scale respectively minimize the organization’s transferred cost for the IS-development. Here, the IS-development is carried out with internal resources whereas the governance may be shared.

<table>
<thead>
<tr>
<th>Table 2: Standardization of commodities in accordance to the dimensions of sourcing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dimension</strong></td>
</tr>
<tr>
<td>Degree of Integration</td>
</tr>
<tr>
<td>Duration</td>
</tr>
<tr>
<td>Allocation of Control</td>
</tr>
</tbody>
</table>
**Strategic Partnerships**

In line with Roy and Aubert [15], the main goal of the sourcing mode is to access complementary resources and capabilities to inhouse competences while retaining ownership and control over IS-activities. The potential dependency on the supplier knowledge is addressed through mixed teams where internal personnel gradually gain knowledge and takes over responsibility [15]. This sourcing mode is in accordance with Roy and Aubert [15], nevertheless, we added the word *strategic* in order to stress the strategic intention underlying the partnership. We define it as follows: A strategic partnership aims to gain access to complementary resources and capabilities that are not present internally. Herewith, the organization retains the ownership and control over the IS-project that is linked to the organization’s strategic needs.

*Table 3: Strategic partnership in accordance to the dimensions of sourcing*

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree of Integration</td>
<td>Internal and external resources</td>
</tr>
<tr>
<td>Duration</td>
<td>Short-term, long-term</td>
</tr>
<tr>
<td>Allocation of Control</td>
<td>Full governance by the organization, residual rights are owned by the organization</td>
</tr>
</tbody>
</table>

**Outsourcing as a service**

In this mode the customer has least control among the sourcing modes. In return, the client uses a minimum of its own resources and pays only a fee for the service that was actually used. Conclusively, the client neither owns appropriate resources nor wants to develop competences related to development of IS. In the long run, the organization does not assign a strategic value to the IS. *Outsourcing as a service* implies that the residual rights are owned by the supplier during the delivery process as it owns the required resources for the IS-development. The responsibility for delivery is exclusively on the part of the external supplier, i.e. no governance on the client side during the delivery process but at the acceptance test.

*Table 4: Outsourcing as a service in accordance to the dimensions of sourcing*

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree of Integration</td>
<td>External resources</td>
</tr>
<tr>
<td>Duration</td>
<td>Long-term</td>
</tr>
<tr>
<td>Allocation of Control</td>
<td>Full governance by the supplier, residual rights are owned by the supplier during the delivery process</td>
</tr>
</tbody>
</table>
3 Our Theoretical Framework

Embraced as the foundation of our study, the categories from Roy and Aubert [15] are adjusted to the four alternatives of sourcing: insourcing, strategic partnership, standardization of commodities, and outsourcing as a service. In the upcoming section, we introduce the IS-sourcing model from Roy and Aubert [15] and link it to the four modes as our theoretical framework. Using the four sourcing modes derived, we state the implicit propositions from Roy and Aubert [15] explicitly.

Using the RBV, Roy and Aubert [15] derived two main factors that drive the sourcing decisions in relation to the firm’s resources; the presence of appropriate resources and the strategic value of those resources. The strategic value of the firm’s resources is represented by the relation between the value of the IS and the resources’ contribution to its development. Thus, the resources the firm has in its possession can only be measured indirectly by the value of the IS [15].

3.1 Strategic Value

A resource may contribute to a strategic goal and organizational success – such as cost reduction – without being a source of sustained competitive advantage: “IT adding value to a firm – by reducing cost and/or increasing revenue – is not the same as IT being a source of sustained competitive advantage for a firm” [10]. In comparison to Roy and Aubert [15] we want to specify the quantification of the strategic value in accordance to the VRIO framework developed by Barney [18]. Following from our perception of this, a resource holds a high strategic value only if it is potentially a source of temporary or sustained competitive advantage. On the contrary a resource holds a low strategic value if it is potentially a source of competitive parity. Further, it is expected that the IS-development project is only carried out, if it is to some extent valuable, i.e. sources of competitive disadvantage are not considered.

3.2 Presence of Appropriate Resources

The less the company’s resources own appropriate expertise, the more it will seek to overcome the knowledge gap by accessing external, complementary resources and capabilities. Conversely, the more the company’s resources possess appropriate expertise, the more the company will seek to max out this competence [15].

According to the discussion above, the two main questions that drive the sourcing decisions for IS-development in relation to the organization’s resources are the following [15]:

- Do the resources used in the IS-development activities hold a strategic value for the organization?
- Are the resources needed for the IS-development activities present at a sufficient level internally?

Depending on the constellation, it is believed that one of the sourcing mode defined earlier – insourcing, strategic partnership, standardization of commodities,
and outsourcing as a service – is appropriate. From this perspective the following propositions can be derived which are stated in the article of Roy and Aubert [15] implicitly and outlined here in our own words explicitly:

**Proposition 1: Insourcing**

If the resources used in IS-development activities hold a high strategic value and appropriate resources are available internally, then the IS-development is done in-house

**Proposition 2: Strategic Partnership**

If the resources used in IS-development activities hold a high strategic value and appropriate resources are not available internally, then the IS-development is done in a partnership

**Proposition 3: Standardization of Commodities**

If the resources used in IS-development activities hold a low strategic value and appropriate resources are available internally, then the IS-development conducts the standardization of commodities

**Proposition 4: Outsourcing as a Service**

If the resources used in IS-development activities hold a low strategic value and appropriate resources are not available internally, then the IS-development is acquired as a service

4 Case organizations and Research Method

The study is based on the analysis of four cases in the financial sector, and is built on semi-structured interviews with persons in the upper management in charge of certain outsourcing projects or responsible for strategic sourcing decisions. We have chosen to investigate sourcing projects in the banking sectors since they are appropriate for our research. From our perspective the insightful source for investigating sourcing strategies in IS-development is the person in charge of the organization’s IT respectively sourcing strategy. According to this, we have chosen interviewees who are in charge of the sourcing strategies within the organization. The investigation of each case gives evidence about the applicability of the model developed in our theoretical framework and its predictive power.

<table>
<thead>
<tr>
<th>Financial organization</th>
<th>Interviewee</th>
<th>Interviewees role</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEBank</td>
<td>Mr. Norman</td>
<td>Manager of strategic partnerships in NEBank’s IT-solutions department.</td>
</tr>
<tr>
<td>GDQ</td>
<td>Mr. Berger</td>
<td>Head of the development infrastructure. Responsible for the strategic decisions regarding IS-development sourcing.</td>
</tr>
<tr>
<td>SHBank</td>
<td>Mr. Svensson</td>
<td>Head of sourcing IT-development. Responsible for outsourcing services regarding development and maintenance.</td>
</tr>
<tr>
<td>TreKrono r Bank</td>
<td>Mr. Krona</td>
<td>Head of sourcing and vendor management. Responsible for strategy and contracts of IS-sourcing projects.</td>
</tr>
</tbody>
</table>
The NEBank is one of the largest financial organizations in Europe. GDQ provides a core-banking solution that covers all processes in the field of traditional banking business for cooperative banks in Germany. Stockholm Bank (SHBank) is a leading financial institution in Scandinavia with an international presence offering full banking service. TreKronor Bank (TKBank) is a full service bank that is active in Sweden, Lithuania, Estonia and Latvia with many offices around the world, providing service to both private customers as well as corporations.

4.1 NEBank

IS-development in the Financial Sector
Mr. Norman denoted that IS-development competences in terms of vendor management and IT strategy is a core competence that a bank need to retain internally.

Characteristics of the IS-Sourcing Project
The investigated sourcing project is an outsourcing of the maintenance, operation and further development of the SAP financial and reporting systems with a total number of 300 applications. For the purpose of this outsourcing, the internal employees were transferred over night from the NEBank to the outsourcing supplier. The number of former bank employees gradually decreased from the beginning of the sourcing project in 2006 so that nowadays the majority is located in India. However, there are still 50 internal employees.

Table 6: Case NEBank in accordance to the dimensions of sourcing

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Description</th>
</tr>
</thead>
</table>
| Degree of Integration | • Internal: Analysis, Management  

|                | External: Analysis to Rollout, maintenance, operation |
| Duration        | Continuing, long-term                                                   |
| Allocation of Control | • Joint management forum embedded in detailed service  

|                | descriptions and SLAs  

|                | • Residual rights are owned by the organization |

The Motives for Sourcing
Mr. Norman summarized the motives underlying the sourcing project as: access to talent, cost reduction, increasing flexibility, improving efficiency and focusing core competencies.

The Question of Value
In line with the motives given by Mr. Norman, the sourcing-project is addressing the threat in the financial market arising from new regulatory standards on bank capital and liquidity, Basel 3. As a consequence of the financial crisis in 2007, financial institutions operating in the European market will be bounded to the new capital standards from 2013 on that require banks to hold more and higher quality of capital than before (Basel Committee on Banking Supervision, 2010). The role this sourcing project plays in addressing the current threats is valued relatively high by Mr. Norman.
As he reports, this engagement is one of the first outsourcing projects and enables the organization to rump up further projects.

**The Question of Rarity**
The sourcing project exploits the environmental threats through cost efficiency. According to Mr. Norman, a crucial capability to obtain the strategic goal is the vendor management. As Mr. Norman elaborates, vendor management capabilities are particular rare in Europe whereas in the US the larger banks started to gain experiences in outsourcing in the beginning of this decade.

**The Question of Imitability**
Further, Mr. Norman sees the capability of vendor management as something you cannot acquire but learn by doing, becoming experienced, he said, takes at least five to ten years of engaging in such activities.

**The Question of Organization**
Mr. Norman is convinced that the organization is aware of the need and presence of this capability so that it facilitates the exploitation through setting up structured systems to transfer knowledge from one division to another on all levels.

**Summary**
Considering the RBV and our theoretical framework it can be concluded that before the engagement started, appropriate resources used for the IS-development were present. Furthermore, Mr. Norman reveals that the capabilities needed for the execution of the IS-development does not hold a strategic value as it is seen as commodity: “the translation of the IT-needs to the project and into IT-deliveries is something that IS-vendors can do”. Instead the strategic value of the IS is seen as a source of cost reduction. Outsourcing to a low-cost country, however, does not imply a capability of strategic value per se. Concluding from this, the model for IS-sourcing would suggest *standardization of commodities* as the sourcing mode.

The IS-sourcing is an on-going project where all development and maintenance tasks are on the supplier’s side as it owns the required resources for the IS-development. The residual rights of the IS, however, are still under control of NEBank. Clearly, the mode of sourcing that can be excluded is insourcing. Likewise **strategic partnership** is not appropriate due to the fact that there is no intended knowledge transfer between both parties. Following from this, the applied sourcing mode corresponds partly to outsourcing as a service. Differences arise from the facts that residual rights are not owned by the supplier during the delivery process and also the governance is carried out to some extent jointly. Having this said, the project shares characteristics of the sourcing mode *standardization of commodities*. The supplier benefits from a continuous income stream whereas the NEBank can focus on core competencies so that the cooperation leads to cost advantages for both. Accordingly, there is no clear allocation of a sourcing mode for this case. Regarding cost reduction as the strategic goal underlying this project, NEBank distinguishes between the governance and the execution of the IS-development. Arising from the applied sourcing mode a new capability – vendor management – is needed that is valued as a source of sustained competitive advantage.
4.2 GDQ

**IS-Development in the Financial Sector**

Outsourcing engagements are currently only entered for certain modular projects in a certain time frame or in form of staff augmentation in order to increase the flexibility in software development for focusing strategic projects. According to the given examples from Mr. Berger, the access to external expertise mainly concerns technical skills rather than knowledge of the core banking business.

**Characteristics of the IS-Sourcing Project**

The IS concerns risk management for the creditworthiness of wealthy clients. It is demanded by the ABCBank that became recently a new client of the GDQ and therefore switched to the core-banking system of the GDQ, the sourcing provider of the cooperative union. The ABCBank’s requirements towards risk management cannot be fully satisfied with the current core-banking system so that is was identified as a gap and formalized in a needed IS-delivery. In this sense, this is already a form of outsourcing as the ABCBank hand over the full IT-responsibility to the GDQ. This though is not part of the analysis. Regarding the underlying purpose of GDQ, it is treated as if it is an internal IT-department. The sourcing project is denoted as outtasking meaning outsourcing the development of a modular software component that is developed under the supplier’s governance. As a consequence from the purchase contract the cost for the IS-development can be amortized in the profit and loss statement. Overall the sourcing project is scheduled over 9 month with a workload of 2000 person days whereby ca. 6 internal employees (45 per cent) and ca. 7 external (55 per cent) are involved.

**The Motives for Sourcing**

According to Mr. Berger, (head of the development infrastructure) the necessary expertise for the IS-development is internally present but fully occupied. The shortage of staff member is temporary and is balanced by external support rather than hiring new employees. In order to overcome the bottleneck of staff and avoid governance overhead the project is outsourced to an external supplier. The characteristics of the purchase contract leads to financial advantages as the IS becomes an amortizable property.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree of Integration</td>
<td>• The delivery responsibility is on the suppliers side</td>
</tr>
<tr>
<td></td>
<td>• workload is shared 7 to 6</td>
</tr>
<tr>
<td>Duration</td>
<td>short-term, 9 month</td>
</tr>
<tr>
<td>Allocation of Control</td>
<td>The residual rights is taken over by the GDQ after the purchase is completed</td>
</tr>
</tbody>
</table>

The **Question of Value**

The IS connect all necessary information, evaluate and combine these so that it supports the decision on the creditworthiness of the bank’s credit applicants. As Mr. Berger describes, the IS is a distinctive feature for the calculation of the client’s creditworthiness which allows the ABCBank to work better than its competitors.
However, likewise it does not hold a high strategic value, it is one of many IS, and otherwise the ABCbank had not agreed to outsource this project. According to Mr Berger, it is about the cost efficient provision of an IS that fulfils the requirements.

**The Question of Rarity**

In this case risk management is knowledge that is present in the GDQ but the resources holding that capability are fully occupied. Following from what Mr. Berger stated, this capability is not a core competence of the GDQ and also not a rare competence meaning that it can be acquired cost efficient.

**The Question of Imitability and of Organization**

As the resources involved in the IS-development are not rare the question of imitability and of exploitation of the organization’s resources are not applicable.

**Summary**

It can be concluded that appropriate resources used for the IS-development are present at a sufficient level but fully occupied. As said before, the shortage of staff member is temporary and is balanced by external support rather than hiring new employees. Considering the employees as a resource the conclusion is that appropriate resources are not available temporary. The question of the strategic value of those resources is not being clearly answered. On the one hand the IS provides a distinctive feature which allows the ABCbank to work better than its competitors. On other hand, resources used for the IS-development are not seen as being rare, since it is handed over to an external supplier. The IS is assessed as a source of competitive parity meaning it hold a low strategic value. Conclusively, the model for IS-sourcing would suggest *outsourcing as a service* as the IS-sourcing mode.

Looking at the applied sourcing mode it can be assessed that the governance and residual rights are hold by the external supplier during the delivery process which goes hand in hand with responsibility for delivery. The client is involved in the requirement specification and buys the IS-development as a finalized product. These attributes suit abundantly to the *outsourcing as a service* mode. However, there are some specialities regarding the project settings. First, the client is likewise sub-supplier and in that way involved to an extent of 45 percent. Furthermore, the maintenance and further development is taken over by the client. As a consequence, the project moves in the direction towards *standardization of commodities*.

### 4.3 SHBank

**IS-Development in the Financial Sector**

The only competence that a bank absolutely needs to possess by its own employees is the governance, steering and prioritization of the IT-investments, as Mr. Svensson denoted. In line with this, Mr. Svensson pictured the overall IT-strategy of SHBank including a roadmap that plans to outsource functionality step by step in order to find the cost efficient solution for providing IS without increasing risk or decreasing its quality.

**Characteristics of the IS-Sourcing Project**

Investigated sourcing project concerns maintenance and further development respectively customization of the human resource (HR)-system for SHBank. After a ramp up time of 18 month, the full responsibility for the handling of the standard
software from PeopleSoft was taken over by IBM in 2010. The outsourcing is a long-term engagement whereas the contract between both parties is set for three years. The maintenance is carried out remotely from India from 5 employees and double that size in case of customizations, supported by one contact person in the premises of SHBank. The supplier is fully responsible to maintain the system and install all necessary upgrades and releases. The employees of SHBank are responsible for the requirements specification and governance, the so-called vendor management. The vendor management is supported by internal legal and procurement specialists for the initial negotiation with the supplier.

Table 8: Case SHBank in accordance to the dimensions of sourcing

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree of Integration</td>
<td>The resources needed for the IS-development are owned by the supplier</td>
</tr>
<tr>
<td>Duration</td>
<td>long-term</td>
</tr>
<tr>
<td>Allocation of Control</td>
<td>The residual rights for the customizations are owned by SHBank</td>
</tr>
</tbody>
</table>

The Motives for Sourcing
Mr. Svensson first introduced five sourcing drivers that are identified by the SHBank; need for good skills, cost, flexibility regarding both buying resources and cost, risk, and focus in terms of focus own employees on strategic matters. In this specific case, Mr. Svensson identified cost as the main driver. Overall, the project is valued as success as it reached the cost efficiency goal, eliminated the dependence on external consultants and is governed well.

The Question of Value
Mr. Svensson puts the value of this IS-sourcing project in more general context. This project has its value in showing that the IT is capable to reduce cost but keeping high quality. It is the pilot project within a roadmap that targets the cost efficient provision of the IT in SHBank. By entering the engagement, the SHBank was able to mitigate dependency on few internal employees and gain access to complementary competences.

The Question of Rarity
Competences needed for carrying out outsourcing of the HR-system are vendor management as well as legal and procurement expertise. The functional competence concerning the HR-system is valued as not relevant to keep in-house.

The Question of Imitability and of Organization
As the resources involved in the IS-development are not rare the questions of imitability and of the organization’s exploration of these resources is not applicable.

Summary
Outsourcing to a low-cost country does not imply a capability of strategic value per se, with this said being cheaper labour is not a capability. Further, the governance for the execution of the IS-development is on the supplier’s side as it owns the necessary resources. The residual rights for the customizations are owned by the SHBank. Following from this, applied sourcing mode corresponds most likely to the outsourcing as a service mode. Differences arise from the facts that residual rights are not owned by the supplier during the delivery process. Concerning cost reduction as
the underlying motives of the sourcing project, the SHBank need to have new capabilities namely vendor management and legal and procurement expertise. In the context of this case, these capabilities are valued as a source of competitive parity implying a normal economic performance.

4.4 TKBank

IS-Development in the Financial Sector
Mr. Krona argues that Banks are much more risk averse than other industries when it comes to sourcing. The architectural description is seen as something that should be kept in the bank as well as deployment, which comes in the latter part of the value chain. Everything that is in the middle of the value chain can according to Mr. Krona be outsourced.

Characteristics of the IS-Sourcing Project
The project is part of the TreKronor Bank framework towards the Internet Bank, especially the retail side of the bank. The amount of external employees involved in the project is between 30-50 and varies over time. This is a long term contract with the vendor which is a frame agreement. The project is now finalized and has been delivered.

Table 9: Case TreKronor Bank in accordance to the dimensions of sourcing

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree of Integration</td>
<td>The resources needed for the IS-development are owned by the supplier.</td>
</tr>
<tr>
<td>Duration</td>
<td>Short-term with a long-term frame agreement</td>
</tr>
<tr>
<td>Allocation of Control</td>
<td>Analysis and architectural part is internal responsibility as well as the top level management of the project. External responsibilities include design phase (not overall design), development and test up to unit test. Project management is partly.</td>
</tr>
</tbody>
</table>

The Motives for Sourcing
When it comes to the underlying motives for the outsourcing of the IS-project Mr. Krona identifies three drivers. The first driver is the cost benefit from lower salaries in India than a Swedish employee would have. Secondly, it is about the availability which implies that TreKronor did not have the required competence at that time internally. They did have the capability but not the specific competence or resources. The third driver is the time, the time to market factor and to be able to scale up on a very short period of time. TreKronor Bank managed to live up to the harsh time constraints as well as saving costs.

The Question of Value
Valuing the project it can be said that the valuable factor is the customer usability, the accessibility of functionalities within the retail bank. The underlying threat is that customers abandon TreKronor Bank for another bank. Therefore improving the customer usability is of high importance. The project is essential in addressing threats and opportunities. Taking into account the resources that are needed to carry out this
project Mr.Krona acknowledges the experience from setups in the project management and to have people that can run agile methods as key capabilities. The key capabilities that are in house are project management and stake holder management. Business knowledge is required from the vendor in order to meet the time limits.

The Question of Rarity
Mr.Krona argues that none of the resources or capabilities from the uniqueness point of view are rare, since they all can be acquired from the market – a lot of people can do it. But in contrast he says that the demand for these resources is very high which contributes to a shortage of these resources and capabilities and therefore they become rare.

The Question of Imitability
Here Mr.Krona puts forward that it is hard to imitate the resources and capabilities if the values (implementation of processes) are not put in place internally. The values are hard to copy, and therefore it does not matter what is put on paper as long as the knowledge, experience, culture etc. is not there. In other words, a paper is easy to copy, but if you do not have the values then it will never work.

The Question of Organization
Regarding the question of organization it is from Mr.Krona’s answers obvious that the experience from IS-sourcing projects gives a better understanding of its value. That is why the upper management are the ones that are aware of these values, and try to spread the knowledge to the operational part of the organization as well.

Summary
According to our model the fitting IS-sourcing mode is here strategic partnership. In line with the RBV strategic capabilities with a high strategic value should be kept or developed internally. Therefore the theory suggests that the bank should gain those complementary resources through a partnership in exchanging and keeping knowledge.

In comparison we investigate what sourcing mode that TreKronor Bank actually applies for this particular project. It is a short term project within a long-term frame agreement. The resources are owned by the supplier whereas the residual rights belong to TreKronor Bank. Further, the project management is split between the parties whereas the top level management is exclusively kept internally. Looking at the similarities with the IS-sourcing mode outsourcing as a service it is clear that this project partly meets the characteristics of this mode. What makes this project not outsourcing as a service is the split of control in the project management. In addition, the residual rights are not owned by the vendor during the delivery process. Analysing the mode of sourcing further, it can be stated that there is no intended knowledge transfer between TreKronor Bank and the vendor. This contradicts the base of strategic partnership in exchange of knowledge.

5 Discussion
In answering our research question we will apply a step by step approach were we answer the aims of the research question in step 1 and step 2. Combining these two
steps we will come to the answer of the main research question which is: How can the motives for sourcing and associated strategies (for IS-development in the financial sector) be explained?

1) Financial Institutions Motive for Sourcing and what Strategies that are Applied.

Looking at the motives for sourcing we have identified that these overlap across the cases. The investigation conducted reveals the following common key motives for all four cases; flexibility, access to talent and cost benefit. When analyzing our empirical data we have found many key drivers similar and therefore decided to categorize them into the main resembling clusters:

- **Flexibility:** Scale up the resources bound to the project in a very short period of time, flexibility in terms of cost meaning transform fixed cost for internal employers to variable cost of external one, balance temporary shortage of staff, time to market.
- **Cost benefit:** Cost reduction, avoid governance overhead.
- **Access to talent:** Lack of competence internally, availability, improving efficiency, skills, focusing core competencies, focus in terms of focus own employees on strategic matters, the value of an IS is assessed if the IS mitigates threats and exploits opportunities in the competitive environment that financial institutions face to today.

Taking a closer look at each of the four cases the following motives for sourcing can be found:

- **NEBank:** cost benefit (increased need of cost efficiency, pilot project)
- **GDQ:** flexibility
- **SHBank:** access to talent, cost benefit (pilot project)
- **TreKronor Bank:** access to talent (retaining customers through improved usability)

From this we can conclude that major motives for selecting IS-sourcing modes are access to talent and cost benefit. After that comes flexibility as a motive. Access to talent would according to the RBV be knowledge and experiences that are not easy to copy. Here talent itself is seen as a resource and can be alluded to vendor management (since access to talent depends on the talent that a specific vendor holds). This resource is valuable for our case organizations since it has high strategic value in terms of gaining sustained competitive advantage due to its connection to organizational values and core competencies. The second motive for sourcing mode is cost benefit, which is not directly seen as a resource of strategic value from RBV. It is rather indirectly a resource of strategic value, since a cost benefit implies that the organization has some kind of financial benefit, giving it more money left to invest in something else such as access to talent for instance. The least occurring motive is flexibility. Flexibility is here seen as the ability of the organization to live up to the time constraints that have been put on the project, and to balance the shortage of staff, in other words it is the organization’s ability to mitigate threats and find new opportunities under pressure.
2) Comparison of the Applied Sourcing Mode to the Derived Mode from the Theoretical Framework

Based on the empirical findings, applied sourcing mode and mode suggested by the theoretical framework were independently conducted for each case. The results from the investigation are presented in table 10.

Table 10: Comparison of the applied and derived mode from the theoretical framework

<table>
<thead>
<tr>
<th>Case</th>
<th>Theoretically derived sourcing mode</th>
<th>applied sourcing mode</th>
<th>Success</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEBank</td>
<td>standardization of commodities</td>
<td>outsourcing as a service mode/standardization of commodities</td>
<td>Yes</td>
</tr>
<tr>
<td>GDQ</td>
<td>outsourcing as a service</td>
<td>outsourcing as a service (GDQ involved as sub-supplier)</td>
<td>Yes</td>
</tr>
<tr>
<td>SHBank</td>
<td>outsourcing as a service</td>
<td>outsourcing as a service (residual rights are owned by SHBank)</td>
<td>Yes</td>
</tr>
<tr>
<td>TKBank</td>
<td>strategic partnership</td>
<td>outsourcing as a service/strategic partnership</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Divided in four modes, the definition of the applicable sourcing mode was derived from the presence of appropriate resources and its strategic value. Starting from a broader scope and narrowing down, it can be concluded that the empirical findings do support the general assumption that internal resources and their strategic importance for gaining a competitive advantage are considered when selecting sourcing mode. Further, the empirical findings reveal that the modified model from Roy and Aubert [15] does explain the applied outsourcing mode to a certain extent. Even though the applied sourcing modes vary in its characteristics from the defined sourcing modes, the applied and theoretically derived modes are for all cases comparable. Considering the variety of possible modes of sourcing in practice and the limitation of a model that by its nature tries to simplify the observed real world, this outcome can be interpreted as support for RBV and the modified model of IS-sourcing.

6 Conclusions

The question asked in this research was: How can motives for sourcing for IS-development in the financial sector be explained?

It can be concluded that RBV gave the explanation behind the motives for sourcing as well the identification of resources or capabilities that are of strategic value for sustained competitive advantage. Analysing this, the selection of sourcing mode becomes more comprehensible in terms of understanding and comparing applied mode of sourcing with RBV suggested mode of sourcing.

Looking at motives for sourcing we have identified flexibility, access to talent and cost benefit across our different empirical studies. The RBV approaches IS-sourcing
from the internal analysis of its resources and the questions whether those resources mitigate threats and address opportunities. In order to achieve strategic goals, resources are needed that enables the organization to carry out its strategy. For the investigation of the four cases, the RBV helped to identify these resources and its strategic value. Regarding access to talent it was identified that needed competences was not present internally in the organizations. The organization’s need for flexibility was caused by labour regulations; however, the underlying basic thought is the competence of internal resources that is maybe present but not at a sufficient level. When it comes to cost benefits the analysis of the organization’s internal resources has to be seen in two steps. The first step is the relocation of IS-development to a low-cost country, maybe even though this capability is present internally. As argued before, the relocation of the IS-development to a low-cost country cannot in itself imply a capability of strategic value. Further, it has to be noted that the salary more or less can be seen as a measure of the resources productivity and efficiency. Following from this, this thought contradict RBV that always involves internal resources if they are appropriate and present at a sufficient level. Nevertheless, subsequently to the attempt – save cost through outsourcing – new capabilities are needed that enable the organization to manage this engagement. This capability – vendor management – is crucial to be kept internally and could be assessed as a potential source of sustained competitive advantage. With this said gaining cost benefits is linked inevitably to the analysis of the organizations internal resources and associated capabilities. In a nutshell, the motives for IS-sourcing are driven by the analysis of internal resources and its potential being a source of competitive advantage.

References

Spanning the Boundaries of Benefit Management: 
A Case study

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The management of benefits of investments in IT and in IS is of increasing importance in practice as well as in research. Recent research on benefits management focuses on activities, competencies, and methods, yet there is still a lack of research seeking to explain its complexities and difficulties. In this paper we report from one case study of a Danish public organisation where benefits have been explicitly addressed in a business case and where deliberate activities have pursued the realisation of these benefits. In addition to background data provided by a large action research study, specific data about the case of benefits management were collected through qualitative interviews. The benefits management in the case is based on what benefits are and how they should be pursued in the municipality. This process is then analysed through the lens of theory of boundary spanning activity and with a particular focus on boundary object and boundary actors. The analysis shows the nature of the boundary spanning activity. The paper thus contributes with a detailed understanding of benefits management as a boundary spanning activity. This understanding is explained in terms of new propositions that are related to the existing literature.

Keywords: Business case, benefits management, boundary spanning, boundary object, boundary actor.

1 Introduction

The primary goal of implementing a new information system (IS) for most organisations is to gain benefits from it. This is not a trivial matter, and it has been explored for some time within the IS field [25]. Different ways have been uncovered to approach the problem of gaining and maximising the value of IS. This is not only a question of engineering the proper system from a technology viewpoint. Changes enabled by IS must occur in the organisational activities, before real benefits can be achieved [12]. Creating this match between what IS enables, and the organisational changes with value creation as a consequence, is enhanced by a broader complimentary fit with the organisational, individual, and technological setting [3].

Several methods and frameworks have been proposed on managing this match with a focus on gaining value. This paper is based on the ideas and frameworks behind Benefits Management (BM). These have a particular managerial focus on benefits realisation and argue that it improves the link between IS investments and
business objectives, actual changes in organisational activities, and obtaining a real value from new IS [12], [23], [29]. This has led to methodologies [17] providing prescriptive guidelines for the application of techniques and organisational management of the process. However, research on these methodologies is still rather immature and further work is needed, particularly on BM in practice and considerations to other related research streams [7].

One aspect of IS implementation projects is the typical inclusion of actors and stakeholders from multiple organisations and departments. These participants often have different backgrounds, different goals, and may not share a common language. The difference between these groups can be referred to as boundaries [33], which must be spanned when collaboration is needed in order to effectively share knowledge and solve a common goal. Research has shown that boundary spanning affects IS implementation projects [22] and success rate of IS projects [13]. BM is directly related to both implementation and success, and we therefore argue that BM can be analysed through the lens of a boundary spanning framework. Investigating boundary spanning in benefits management would therefore contribute to a better understanding of how to manage for benefits.

In this paper we present a case study of a cross departmental IS project, where data was collected on benefits management efforts, which were analysed to characterize the boundary spanning activities that occurred during the process. The detailed understanding of the boundary spanning activities are then explained in terms of new propositions. Thus, we aim to contribute to the understanding of BM in practice, and further develop the link between BM and other research streams.

The paper is organized as follows: First we outline BM to provide an overview as well as the theoretical framework of boundary spanning. The research approach is described and a short description of the case municipality follows. Afterwards, we present the analysis of boundary spanning in the case project, and these findings are subsequently discussed and their implications for practice and research.

2 Benefits Management

Benefits management has been defined as "The process of organizing and managing such that the potential benefits arising from the use of IT are actually realized" [39]. In organisations, the efforts of justifying potential benefits are far more common than the process of ensuring that the anticipated benefits are actually realised [14]. Several models and frameworks have been developed with a focus on changing this practice and actively manage for a match between proposed benefits and actual realised benefits.

The most dominant framework originated from the work of researchers at the Cranfield School of Management [40]. A process model of management focused on the realization of benefits of IS investments with five linked steps: Identifying and structuring benefits, planning benefits realisation, executing the benefits realisation plan, evaluating and reviewing results, and potential for further benefits. Similar models for realizing IS benefits have been developed such as Active Benefits Realisation [31], model of Benefits Identification [10], and The IT Benefits
Measurement Process [1]. These models have a managerial focus on a benefits realisation process with similar steps and tools. The initial Cranfield process model has later been expanded into a number of tools and methods positioned under strategic planning and portfolio management with an integrated link to change management methods, systems development methodology, project management methodology, risk management techniques, and investment appraisal [39].

The most important aspect in gaining benefits of IS investments is that IS on its own does not deliver benefits [40]. The benefits occur as a change in how things are done, where IS is an enabler [16]. In BM, the importance of stakeholders and their inclusion into the process has been emphasised [17], [29], [39]. It is therefore necessary to understand who is affected in the implementation of IS, how they are affected, and what the dynamics between them are. Multiple stakeholder analysis techniques with a focus on change management could be applied [39]. Another approach is analysing dependencies between investment objectives and requisite benefits anchored with specific stakeholders [29]. The influence stakeholders have on understanding, predicting the benefits accurately and later realise them is also an important step [17]. However, these techniques lack a focus on the challenges on knowledge sharing and collaboration between the stakeholders.

The benefits management literature has a prescriptive nature in the aspect of stakeholder activities, where the focus lies on what needs to take place. However, the literature is vague on the difficulties this represents. Different research streams have sought to uncover these difficulties from their own vantage point. It would be useful to extend BM to include such insight. In this regard, it would be particularly useful to look at a line of research that focuses on collaboration and knowledge sharing between groups that play different roles in the process.

3. Boundary Spanning

The concept of boundaries is intuitively understood, at least when it comes to physical or visual boundaries, such as country borders and house lots. It is clear that each side is different in some way and it takes effort to cross this. In organisational science the concept of boundaries extends beyond this simple understanding. In the seminal works of Star and Griesemer [33], and Carlile [9] the boundaries are set within a context of understanding knowledge and transferring knowledge. They argue that boundaries exist between different social groups, who each have their own dialect and knowlede. A social group may be distinguished by a difference in location, knowledge background, culture or the functions that they perform. [33]. An example could be research groups at the same research institute, each with their own research agendas and possible outlets. The tendency is that communicating, coordinating, and collaborating across boundaries is done with some difficulty if one or more of these distinguishing factors differ.

There are two general ways in which to overcome this boundary of communication and knowledge transfer. Either the boundary is eliminated through acculturation, or a spanning of the boundary is facilitated. Acculturation may include colocation or cultural changes over time, where the knowledge background, skill sets and social
worlds blend together to form a new cohesiveness. However, for many reasons, acculturation may not be possible, or even desirable. Thus, spanning the boundary has been of great interest in organisational science and research fields connected to organisations [32].

Boundary spanning is important, since in most work environments there is a significant value in successful communication, coordination, and collaboration between different social groups. Examples may be collaboration in a museum [33], new product development [9], collaboration in public service [27], innovation efforts [34], and IS projects [13]. In the context of IS projects and realising the benefits of these projects, there are multiple arguments for focusing on boundary spanning. Firstly, many IS projects take place as a collaboration between organisations, either between separate organisations or within larger organisations that include a number of sub organisations in separate locations. A number of different knowledge backgrounds and skill sets may be represented. Even if the implementation of the projects is isolated to a single organisation with a cohesive social group, there are usually actors from IS departments or vendors and actors from the implementing organisation mixed into the process. Secondly, the overall management of benefits realisation is an alignment of processes and people towards a common goal, where the capability of realising benefits is connected to the benefits realisation competences and benefits realisation practices [2].

The spanning of boundaries is facilitated in two general ways; either through objects that mediates communication and knowledge or actors, who often have unique properties. Boundary objects (BO) has been referred to as a translation device [15], as an interface between different individuals and/or organizations [20], information artifacts used to communicate between teams enacting an influential role as a guide for team collaboration [30], an important means of transforming knowledge and changing practice across specialist knowledge domains [26]. Star, who originally coined the term, defines BO as an object with a relevant scale and scope, which derives its existence by the interaction that it facilitates between groups [32]. It is this definition we follow in this article when referring to BO. Boundary actors (BA) are sometimes referred to as boundary spanners or boundary spanning individuals. They are distinguished by their ability through skills and knowledge to effectively communicate on both sides of the boundary [35]. They can take on a specific role either through nomination or in practice [22]. We refer to BA as actors who have ability to cross boundaries, either through inherent competencies and familiarity with involved social groups, or through effort to achieve competencies and familiarity during the process. These actors then facilitate communication and knowledge sharing by performing a boundary spanning role.

The framework for analysis in this paper identifies and characterises social groups and their boundaries, boundary actors, and boundary objects. Social groups are defined by differences in their location, knowledge background, culture, and functions they perform [33]. The strength of a boundary is further classified by the novelty and uncertainty of the collaboration [8]. This classification from least to most novel and uncertain includes; a syntactic boundary, a semantic boundary, and a pragmatic barrier. A syntactic barrier only requires a transfer of knowledge, since common language is mostly shared. A semantic boundary requires a translation of knowledge, since common language is no longer shared. This is best done by actors spanning the
boundary. A pragmatic boundary requires a transformation of knowledge, since common language is no longer shared and a transformation is required before it can be translated. In extension the classification of BOs follow the same pattern. Boundary objects can support a spanning of syntactic boundary, a semantic boundary, or a pragmatic boundary. The classification of Boundary actors is adopted from Fisk, et al., where actors may act in a boundary spanning role and have a competence that can span IS and business [13]. Boundary spanning roles include: ambassadors who represent their group and interact with external groups, coordinators who facilitate knowledge flows between groups, scouts who seek out knowledge from external sources. Thus the strict business/IS competence scale used by Fisk et al. is expanded to differentiate between different business competencies. This is necessary, since our group definitions extend to more than business and IS groups. This classification is useful to identify if a particular beneficiary mix of competences is facilitating boundary spanning between groups.

4. Research Approach

Relevance of information systems research is a primary concern and engaged scholarship is an overarching research methodology where the focus is on creating relevance for practitioners. Engaged scholarship is defined as “a participative form of research for obtaining the different perspectives of key stakeholders (researchers, users, clients, sponsors, and practitioners) in studying complex problems”, and it focuses on this particular challenge for research [36]. Van de Ven argues that the theory-practice gap, which often occurs, can be countered by a closer collaboration between scientists and practitioners.

Action research, which has previously been applied in IS research, is a group of research methods where practitioners become engaging practitioners [4], [11], [19], [24]. The premise of action research is both to intervene into and address a problem in a specific setting while at the same time contributing to academic knowledge. We applied action research [24] in a research project focusing on the values created by IS in the context of Danish municipalities. As advocated by Mathiassen, an action research project can serve as the research setting in which data can be collected and analysed for a case study.

The study presented in this paper is a case study [5], [21], [38] of IS benefits management performed within the larger action research project. The case study was conducted in a municipality that was partaking in the action research. The data collected were case study data, because the municipality participants were the only actors, and the researchers were acting as participant observers as well as interviewers. Hence, the researchers had a broader background from the action research in which the case studies were embedded. The study was thus designed as a case study based on qualitative data and on interpretation as the primary strategy for data analysis [37]. Interpretive research allows us to see boundary spanning of benefits management in its organisational context as socially constructed and thus open to several interpretations by organisational actors but also to as researchers [18].
Within the municipality, a case of benefits management was chosen, having as primary requirements were the following: benefits management had to be spanning multiple departments or groups within the municipality; the information systems had to be commissioned and in use; benefits management had to be ongoing. This would allow an exploration of the boundaries crossed between department and groupings, and during the period from the initiation to after the commissioning of the system.

The data collection was designed to capture the essence of the collaboration between actors and how objects are used, and to this end, qualitative interviews with key actors were conducted. In addition, documents potentially serving as boundary objects were studied in detail. The interview strategy was a mix between an interview guide approach and a standardized open-ended interview [28]. According to Patton, this mix allows for comparability and important topics are answered, and at the same time flexibility is needed to complement the standardized open-ended interview lacks. Asking the same questions with the same wording can alienate some social groups, thus making it difficult to obtain the worldview of the subject. The strategy was therefore to structure the interviews with an interview guide, but extending this with a sequence of “must ask” open-ended questions pertinent to the investigation topics, that are customized to the social group that the subject is believed to be a member of. Five key actors were interviewed. The interviews were from 30 to 60 minutes in length and were audio recorded and later transcribed.

The overall principle of the data analysis follows the assumptions of interpretivism [37]. This is based on the view on knowledge of reality as socially constructed, particularly when dealing with human action and interaction in organizations. Analysis was performed on the recordings of the interviews, which were encoded using the following process:

- Identify social groups with a particular focus on groups sharing knowledge and at the same time identify boundaries.
- Identify boundary spanning objects and actors.
- Analyse the boundaries, boundary spanning objects, and boundary spanning actors using the theoretical frameworks, cf. boundary spanning section.

By narrowing down the theoretical frameworks and using these to frame the data collection, a data-theory link has already been established. Analysis could then proceed by frontloading the theory, which also framed the data collection. In this process the within-case data is analysed inducing the theoretical output of the study [6].

5. Case

The case municipality has a population of around 70,000 inhabitants situated in 25 km², a suburb of the Danish capital with a reputation of being a wealthy neighbourhood. Multiple awards have been given to the municipality on IT initiatives and it is generally known for being on the cutting edge in e-government. The largest population group of the suburb is 40-49 year olds, with a large group of 10-19 year
olds as well. The housing is roughly 2/3rds apartment buildings and 1/3rd single family houses. Large houses are twice as common here compared to the country average. The municipality employs roughly 6,270 and has a tax income of 538,000,000 euros. The administration is centralized in one location, in which IT projects are managed by a centralized IT administration.

5.1 Case Project

The organisational implementation of a citizen service system for allocation of day care has been under way for 3 years. Day care placement refers to the services provided by the municipality, where parents enroll for childcare, and are then assisted in finding and allocating the best possible placement for them. Prior to the case project this was handled by a team at the municipality service centre. The system is specialised and developed from scratch, and it includes a front end on the web, where citizens can process the requests and ultimately the assignment of day care places of children. Additionally, a backend was included for managing capacity control in the day care centres.

The budget of the project was under the threshold of a mandatory public procurement procedure, which in turn would otherwise have mandated the whole process including increased uncertainty around the external partners.

At the initiation phase partial funding for the project was acquired from a public fund. The funding was provided on the basis of an application form that required, among other things, a description of expected benefits and how to reach them. This means that incentive for early analysis and awareness of benefits was present even before the actual project implementation was started. These benefits included in short:

- Payroll cost decrease by removing the service team previously handling placement.
- Payroll cost decrease by removing buffer childcare, as a result of better capacity control.
- Less coordination meetings with centre managers due to automation.
- Increased service and transparency for citizens.
- Increased level and access of information required for capacity control.

The implementation of the project achieved these stated benefits and was deemed a success. However, some benefits were only reached through an additional effort and addition to the system after initial commission.


In the benefits management of the organisational implementation five social groups were involved. Each separated by a difference in one or more of the four boundary
creating properties (location, knowledge background, culture, and functions performed). A label and an outline of the groups and their defining differences follows:

- **Management**: the municipal departments participating in the project each are represented by managerial staff participating in steering committee, project ownership, or other decision level positions. These are a part of one of the social groups. The distinguishing differences here are the knowledge background (management and economy mainly, some business domain knowledge) and their function (manage and working with each other to administrate the municipality).
- **IS**: The second group consists of IS personnel (in this case referring to members of the digital solutions team and IT city hall). The distinguishing differences here are knowledge background (knowledge of IS endeavours in municipalities and IS project management) and their function (staff/support and coordinating/collaborating across organisations).
- **Service**: the third group consists of the service team that used to perform day care placement, having as distinguishing differences knowledge background (customer service, the service orientated administrative systems, the Danish day care system) and function (customer service).
- **Administration**: the fourth group involved are administrative members of the department of children and young people. The distinguishing properties here are the knowledge background and their function. The knowledge background is focused on legislation in their area, how to administrate, the care taking system, and other areas covered by their department. Their function is to administrate.
- **Day care**: The last group consists of the centre managers of the care taking facilities. The distinguishing properties here are the knowledge background, location, and function. The knowledge background is focused on pedagogy, child care, and administration of a day care centre. Their function is to interact with children and personnel in the centre, other centre managers, and occasionally the administration of children and young people.

In the process of realising benefits multifaceted boundary spanning occurred. **Management** spanned the boundary to **IS** and **administration.** **IS** in turn spanned the boundary to **management, service, administration, and day care.** **Administration** spanned the boundary to **service and IS.** **Service** spanned boundaries to **administration** and **IS.** Finally **day care** spanned boundaries to **service and administration.** An overview can be seen in figure 1.

The boundaries spanned had a varying degree of strength. The boundary between **management** and **IS** was the weakest boundary, since common language is mostly shared and collaboration is not novel in nature. Knowledge transfer between the two groups was pre-arranged to a certain degree with a structure of meetings and documents serving as boundary objects. This makes the boundary syntactic in nature and boundary spanning occurred as a transfer of knowledge. Novelty is increased on the remaining boundaries. Collaboration is novel in nature and common language has to be developed. The boundary takes a semantic nature, where knowledge is translated across boundaries.
6.1 Stages in the Benefits Management Process

Analysing the process of benefits management through the lens of boundary spanning revealed that crucial boundary objects and actors changed over time. This is the case not only in the interaction they had in the process, but also in a change of the actual objects and actors. These changes happened due to a change in importance of the participating groups at any given stage, and a change in the boundary spanning needed to facilitate the crucial knowledge transfer and collaboration at any given stage. In the analysis of these, it is useful to see the benefits management process as a timeline with three different stages: a project initiation stage, a project stage, and an operation stage.

Initiation stage:
In the initiation stage the BM activities were centred on the identification and structuring of benefits, as well as planning the benefits realisation. The important aspects here are the accuracy of the proposed benefits and feasible plan for how to achieve the benefits realisation. This requires knowledge of the business domains affected by the implementation as well as knowledge concerning feasible IS solutions. In this case the idea originated from members of management and members of IS collaborating on innovations in digitalisation. Here knowledge from the business domain and municipality management was represented by members of management, and knowledge of feasible IS solutions was represented by members of IS. These served as the primary BAs in the role of ambassadors and spanned the boundary between each other by transferring knowledge. This led to the identification of possible benefits in investing in the case system. This prior constellation reduced the need of acquiring knowledge compared to other idea inception paths, such as purely from a political, management, or IS starting point.

Later in the initiation stage, the semantic boundary to service, administration, and day care was spanned through a member of IS serving the role as scout seeking relevant information from administration and service. This resulted in an increase in knowledge by translation, which was later transferred by ambassadors from IS to management. A BO was constructed to facilitate this transfer in the form of an application form for external funds. The information represented by the application form was later used in other BOs. These served to facilitate boundary spanning between IS and management, as well as in the boundary spanning actors from IS performed later in the project. These BOs were a project initiation document (PID) form and later a business case for the project. The use of the BOs of the application...
form, the PID, and the business case primarily served as a transfer of knowledge between the syntactic boundary of IS and the managerial group.

Project stage:
In the project stage the BM activities were centred on executing the benefits realisation plan. While management still played a part, in this phase the importance shifted towards service and administration. The participation of these groups was primarily aimed towards development, testing and adjustment of the system. However, at a glance these activities seem directed towards development of the system, rather than a part of the benefits management process. It is important to realise that a correct system, and thereby a system that supports the changes required, is directly related to the successful execution of a benefits realisation plan. Thus, while the activities of this stage are anchored in the previous one, the need for collaboration and knowledge sharing shifts closer to the business domains.

Members of IT and management still performed roles of ambassadors collaborating with each other, thus spanning the syntactic boundary between them by transferring knowledge. Boundary objects in the form of a business case, as well as minutes from project and steering group meetings assisted in this effort. The result of this boundary spanning was a continuous evaluation of planning and executing of the benefits realisation plan. Actors from IS performed a dualistic role of coordinator and scout. In the role of coordinator the actors assisted in the collaboration effort and boundary spanning through translation between administration and service. Prototypes of the system itself became a BO used as a translation tool in the collaboration effort coordinated by IS between administration and service. In the role as ambassador the actors from IS spanned the boundary from IS to administration, and from IS to service. This facilitated the translation of domain knowledge and knowledge pertaining to the execution of the benefits realisation plan, the latter being a two-way knowledge translation. These efforts resulted in a closer match between planning and executing the benefits plan. An actor from service served as ambassador, spanning the boundary with the IS coordinator. This effort further increased the knowledge translation between service and IS.

Operation stage:
In the operation stage the BM activities were centred on evaluating and reviewing results, as well as ensuring that the benefits were solidified. Importance was shifted even more towards the business domains. Two primary actors were instated in a post implementation effort to evaluate the system and ease transition. These actors, one from service and one from child care, acted as ambassadors. Assisted by the system serving as a boundary object, they spanned their boundary and collaborated on translating the knowledge on the match of the system to the desired benefits. The day care ambassador also spanned the boundary to and from his peers. This helped increase a match between system and domain, as well as benefits planned and benefits realised, as feedback and training occurred from and by other day care managers. A member of the IS group acted as a coordinator to further facilitate this collaboration between the two ambassadors. This actor in turn functioned as an ambassador and translated knowledge from this constellation to management. This resulted in a
revised business case on a system change, when it was discovered that initial benefits were not realised.

6.2 Boundary Actor Competence

Boundary actors and members of the social groups involved in general had competencies closely linked to the knowledge background and function of their groups. Members of IS had a natural inclination towards boundary spanning activities, since their function was a coordinating one. No particular competence in the business domains was found in the members of IS, though. Colocation and similar culture might have contributed to an easy collaboration with members from the other groups, and thus a further increase in boundary spanning capability disjoint from direct relation to competencies was present.

In general, ambassadors from the other groups facilitating boundary spanning during the process possessed same tendency to have an overwhelming competence in their domain. The exception was perhaps ambassadors from management, who possessed some competence in the possibilities of IS. The boundary between IS and management was also the weakest between the groups, partly because collaboration and knowledge sharing was not novel to them. This might have caused the added competence within management. The ambassadors from service and child care were both if not with a competence in the possibilities of IS, then they were inclined and interested in implementing the project. This was a deciding factor in these individuals becoming ambassadors. No such strong ambassador existed in the administration group and knowledge sharing suffered as a consequence. A lack in knowledge from the administration group was the major cause of the mismatch in the initial system that caused a secondary project to be initiated, in order to realise the remaining expected benefits.

7. Discussion

Through the analysis of the case municipality, we demonstrated the framework of boundary spanning, which provided an insight into the dynamic between different identified groups participating in the process. Similar attention has been brought to participants within the organisation that is implementing IS projects in BM literature [17], [29], [39]. These participants, often referred to as stakeholders, are stated as having a significant impact on the ability to realise benefits. The findings of the analysis presented in this paper represent an extension to this literature on understanding the dynamics of the participants. The case study also contributes to the empirical understanding of benefits management in practice.

Three main findings can be taken from the analysis.

- Boundary objects and actors vary over time in benefits management.

In the BM literature there are at least four steps in the process: identifying and structuring benefits, planning the benefits realisation, executing the benefits
realisation plan, and evaluation result with a focus on discovering potential unrealised benefits [39]. The underlying elements to this process are that a system is usually implemented, changes might occur in the organisation as a consequence, and someone starts using the system. The analysis showed that the actors doing the planning (IS and management) differed from the actors that supplied knowledge for the implementation of the system (primarily administration and service). Similarly the actors with the main connection to the system post implementation differed from the others (service and child care). The analysis also showed that the boundary objects used to facilitate knowledge sharing pertinent to the benefits management process differed. Different documents were in use, as well as the system itself. In BM literature there is an emphasis on coherence in the different stages so expected benefits match actual realised benefits [39]. The finding that objects and actors vary over time is important in that implies a risk of losing the coherence between stages.

- The primary boundary spanning objects are: a business case, project control documents, and the information system. The analysis demonstrated a use of boundary spanning objects to facilitate boundary spanning activities. In the case of the system as a BO in the operational stage, there would be no knowledge sharing without it. The business case captures the benefits contract that the implementation is abiding. Thus, it serves as an anchor for the premise of the project and constantly feeds back into the process. In a successful benefits management process the knowledge sharing must take place. In some cases there is a need for objects to translate knowledge, transfer it, or otherwise solidify it in the process.

- Primary boundary spanning actors are: IS managers (coordinators), business manager (ambassadors), and actual users (ambassadors).

The analysis demonstrated that boundary actors were necessary to facilitate the knowledge sharing and collaboration. The IS managers were particularly important in the knowledge sharing within the benefits management process, where they mostly served as coordinators. They spanned the boundary to each of the other groups, often bringing the knowledge gained into new groups. In BM literature the topic of ownership in implementation projects is important. When business managers effectively serve as ambassadors, as in this case, the benefits management effort is supported by the knowledge they bring to the project. Similarly with active users who acts as ambassadors in a timely fashion will assist in the knowledge sharing in relation to the implementation scenario.

We believe this case to be representative in nature for successful benefits management. Thus, the results might be generalisable, though further case studies are required to test the robustness of the framework as an analytical tool.

7.1 Implications for Research

The framework used in this paper to analyse boundary spanning in the case benefits management process showed analytical power to identify boundaries, boundary
objects, and boundary actors. The boundaries represented challenges that were overcome and the boundary actors and objects represented solutions to these challenges. If we transfer the understanding of boundary spanning analysis to Ward and Daniels stakeholder analysis [39], it would increase chances to anticipate potential challenges and plan solutions for them. In its current form the stakeholder analysis is based on a change management perspective, which assumes resistance and need for inclusion. Management approach is then based on the knowledge of stakeholders affected by the implementation and their perceived resistance. This does not take into account the difficulties of boundaries. From an analytical standpoint this causes a reactive approach in dealing with boundary challenges. Amending the stakeholder analysis with a boundary spanning analysis would change the approach to preventive. If Carlile's [8] understanding of boundaries as syntactic, semantic, and pragmatic is applied for instance, then there would be an increased foundation of a successful planning of actor and object uses through the process. If a boundary was syntactic, then that would imply that simple information transfer objects could be used. If a boundary was semantic, an increased focus on finding a suitable actor for translation could be found. If a boundary was pragmatic, prototyping objects could be combined with suitable actors for translation. The analysis indicated that the lack of initial realization of benefits was caused by a missing strong boundary spanner in administration.

In a similar situation, an analysis using the boundary spanning framework could have identified this challenge, and a solution could be facilitated beforehand. Similarly, the analysis showed a weak boundary between IS and management, which helped facilitate the initiation of the project and a good understanding of the IS possibilities. In a hypothetical situation with the adverse situation, an analysis would identify this challenge, so a proper solution could be found. Investigations to expand the boundary analysis to external organisations such as IS vendors or collaboration partners would also be a natural step.

7.2 Implications for Practitioners

A focus on boundary spanning would alleviate the challenges performing successful IS implementations through benefits management. An understanding of the different boundaries would facilitate initiatives to meet the challenges in a timely manner, especially in environments where novelty in the implementation projects is high. This is particularly true in the environment of municipalities where the organisation is populated by many different business domains and knowledge backgrounds.

Conclusion

We have applied a case study on benefits management and analysed it through a lens of boundary spanning. This was done in order to expand on the understanding of the challenges in the collaboration between different social groups in cross organisational benefits management processes. The analytical framework presented for identifying groups, boundaries, boundary actors, and boundary objects resulted in an analysis that
led to the following findings: An understanding of a benefits management process as a dynamic process with changing actors and objects; an identification of primary actors with distinguishing roles, an identification of primary objects with distinguishing roles. Although further research is needed, we showed that the framework has potential as a post analytical tool as well as a preventive analytical tool.

References

Information Technology: From the perspective of Business Management and Marketing

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Abstract. IT researchers need to know more about the concerns of IT within business areas at the same time as IT expands into them. In this literature review, we extensively look into articles published in Business Management and Marketing top journals to get a better understanding of the IT concerns of these two business areas. We make a selection of articles within both areas and extract the main concepts. Then, we inductively classify the concepts into different categories within Business Management: Governance, Implementation, Social interaction and Competitive Advantage and Marketing: Partnership, Firm performance, Acceptance and Internationalization. We present the concepts describing the categories and open a discussion that contributes to a better understanding of alignment between IT and business areas: how IT and business can challenge each other in the improvement of their mutual relationship and prepare to answer key issues within IT.

Key words: IT concerns, IT and business alignment, social dimension

1 Introduction

Nowadays firms concerns become how to be more dynamic to improvise new ideas and implement cross-functional interaction between Information Technology (IT) and business areas as stated by Van den Hooff [1]. Authors, such as Reich & Benbasat, Luftman and Henderson and Venkatraman consider that IT and business alignment plays a relevant role within organisations [2, 3, 4], as well as the development of IT capabilities, to improve the relationship between both areas proposed by Feeny and Willcocks [5]. Bassellier states that Management of IT requires trained IT professionals as well as shared responsibility between business and IT professionals to ensure alignment between IT and business objectives [6].

Engaging IT and business leaders with each other has shown positive results for the performance of organisations as presented by Hansen and Chan [7, 8]. At the same time, most of the business and IT leaders in a global scale, have identified IT and business alignment, business agility and speed to market as their main concerns in 2011-2012.[3]. The study conducted by Luftman
shows business leaders awareness of IT-related decisions and behaviours and the need for alignment with organisational goals [9]. Due to the complexity of IT and business alignment, in stead of aiming to target unreachable multifaceted overall alignment it is preferable to focus on specific components of alignment [8].

From a research perspective Reich & Benbasat and Chong have approached this topic [10, 2, 11]. Chan has clearly identified four dimensions of alignment: strategic/intellectual, which is to what extend the business strategy and plans and the IT strategy and plans complement each other, structural, which refers to the degree of structural fit between IT and the business, cultural, which refers to the type of informal structure that fosters alignment and the social dimension [12].

In this literature review we focus on the social dimension of alignment proposed by Reich & Benbasat. The authors set the focus not only on structural elements within organisations, but on contextual factors to establish the relationship between business and IT leaders, because they directly reflect how business and IT leaders understand each other and how they are committed to the business and IT mission, objectives and plans [2]. Reich & Benbasat and Peppard consider that the relationship between IT and business areas has influence on the social dimension of alignment, because it is not only about finding a shared solution to the mission, vision and objectives created by IT and business leaders, but about creating a shared understanding which ends up on the social and relational level between IT and business leaders [2, 13]. Campbell has observed the behaviours and the relationship established between IT and business areas in terms of how they understand the role of IT and business within organisations and how they establish a relation to each other [14]. As a consequence IT and business leaders need to develop relationship capabilities. Feeny and Willcocks consider that building the relationship between IT and business professionals based on the convincement of understanding goals, concerns, language and processes, that contribute to achieve common goals [15]. The development of capabilities allows the establishment of a relation between IT and business areas to create wider dialogues, trust and enabling cooperation between them [5]. We contribute to the discussion of the common understanding of IT and business leaders within the social dimension of alignment. Therefore the study of the relationship between them becomes useful and powerful to study organisations as analysed by Coughlan [16].

The growing interest on understanding alignment and the relationship of IT and business areas proposed by Chan and Feeny and Willcocks [8, 5] from the perspective of the social dimension [2, 11, 13] discussed by Reich & Benbasat, Chong and Peppard have been in the focus of the IT research literature. Hence, it is necessary to better understand the concerns about IT within business areas to improve alignment between IT and business areas. In this paper we conduct a literature review on Business Management and Marketing publications to know
the concerns about IT. Within the literature review we abstract concepts from a selection of articles and categorise the results. This can contribute to a better understanding between IT and business leaders in organisations. This motivates the research question: **What are the main concerns of Business Management and Marketing about IT?**

Within the next sections of this article, we will describe in Section 2 the methodology of the literature review. In Section 3 we will present the findings obtained from the literature review. In Section 4 we will draw conclusion, present the limitations of this work and suggest future research.

## 2 Methodology

To answer to the research question on what the concerns about IT within the areas of Business Management and Marketing are, we based the research methodology on Websters and Watsons contribution, which emphasizes on the importance of a structured approach when intending to contribute with a high-quality literature review [17]. We list the steps we followed while conducting this literature review as shown in Figure 1. Following this, we describe each one of the steps in the process.

![Fig. 1. Literature Review Process](image)

### 2.1 Research boundaries

In this paper we focus in two IT intensive business areas as a preliminary approach to IT concerns within business areas. We defined the keywords focusing on IT and related terms. However, we have a specific selection of keywords following Okoli’s argument on well documented research boundaries to obtain high quality results [18]. The keywords used are: *Information technology, IT, Information systems, IS, new technology/ies, Computer, PC, digitalization, information and communication technology/ies.*

We selected other parameters, such as a *publication interval* defined as the last *ten years* and the *top ten best ranked journals* in each area. Furthermore we specified the selection criteria on an action card for a manual article selection process.
as proposed by Ulrich [19]. The four criteria are:

C1. Article within one of the areas: Business Management or Marketing
C2. The article was published in at least one of the top ten journals of each area
C3. The article abstract and/or title contains at least one of the keywords
C4. The article abstracts main phenomena [20] concerns at least one of the keywords, focusing on the research and practice perspective of concerns about IT within both areas.

2.2 Journals selection

We selected the best ranked journals within each area. We consider that they offer a better understanding of the concerns about IT, because the discussions and contributions are recognised as valid scientific sources.

We conducted searches using Web Of Science and Scopus/Sci Verse with the queries best ranked journals and journal rankings within Business Management and Marketing. From the search results we obtained contributions such as Mingers, Harzing and Swanson. Mingers contribution focuses on the classification of journals within the area of Business Management [21], while Swanson focuses on rankings within the area of Marketing [22]. After, we conducted a backward-search [17] on the contributions made by Mingers, we found the Journal Quality List made by Harzing. It is an international ranking list over journals, which is continuously updated and includes rankings made by research institutions worldwide. Moreover, it includes journals organized by business areas and journal titles [23]. Table 1 shows the list of the top ten selected articles by area.

<table>
<thead>
<tr>
<th>Business Management</th>
<th>Marketing</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Administrative Science Quarterly</td>
<td>2. Journal of Marketing Research</td>
</tr>
</tbody>
</table>

Table 1. Top ten journals

2.3 Articles selection

Searches After defining research boundaries and search parameters we started researching for articles within Business Management and Marketing. First, we started by doing full text searches using the selected keywords on the database of Scopus/Sci Verse. After we limited the searches to the abstract and title of the publications, so that the number of results was limited to a smaller
amount of recognised contributions. The searches included variations on the search strings. The articles were selected from the results obtained using the Scopus/SciVerse database. We documented the search results into tables containing title, author and abstract for each article and the decision if the article was selected or not (YES/NO). The decision was based on the criteria in the Action card. After conducting the search we obtained 112 articles within Business Management and 76 within Marketing. At the end of the selection we obtained 21 articles within Business Management and 20 articles within Marketing.

2.4 Literature analysis

The literature analysis was conducted using a concept matrix. The concept matrix is a tool proposed by Webster and Watson [17]. It is a matrix table made out of authors on the rows and concepts contained within the articles on the columns. The concepts within the concept matrix are obtained from reading the full text articles. The focus here lies on the research and practice perspective of concerns about IT within Business Management and Marketing. The concepts contained in the articles are matched with different authors in the concept matrix. The concept matrix is used because it enables a visualization of the most discussed concepts throughout the different articles. Thereby the concept matrix enables an easier overview of the concerns about IT within Business Management and Marketing. Table 2 shows the list of concepts and authors obtained for Business Management and Marketing. Based on the results obtained with the concept matrix we elaborated a categorisation. Related concepts were grouped into superordinated terms. Each superordinated term defines a category. This step was taken to reduce the degree of granularity obtained within the concept tables. This means, the amount of concepts within the concept matrix. Thereby, to abstract the main concerns about IT within Business Management and Marketing.

3 Presentation of findings

In this section we introduce our findings. The findings are the results of the used methodology in the literature review to answer the research question, what the concerns about IT within the areas of Business Management and Marketing are. Following, we describe the categories and the concepts related to the selection of articles. Within each category we describe the perspective of IT research and then we introduce the concepts contained within our article selection.

3.1 Business Management categories

Governance and Strategy Within IT research authors, such as Weill and Rose consider governance the decision rights and accountability framework within organisations. This means who is in charge of decision making and who is responsible for the effects of the made decisions [9]. Further, we considered factors, such
Table 2. List of concepts and authors within Business Management and Marketing

<table>
<thead>
<tr>
<th>Business Management</th>
<th>Author(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A0. Knowledge as collaboration platform</td>
<td>[24, 45, 46, 47]</td>
</tr>
<tr>
<td>B0. Implementation</td>
<td>[24, 27, 28, 29, 30, 31, 32, 33, 34, 35]</td>
</tr>
<tr>
<td>C0. Influence on the workplace</td>
<td>[27, 31, 28, 32]</td>
</tr>
<tr>
<td>D0. Investment risk</td>
<td>[36, 37, 29]</td>
</tr>
<tr>
<td>E0. Clear and communicated IT governance</td>
<td>[27, 28, 30, 38, 39, 41, 34]</td>
</tr>
<tr>
<td>F0. Relationship building with other areas</td>
<td>[27, 28, 30, 38, 31, 39, 24, 26, 41, 34, 42]</td>
</tr>
<tr>
<td>G0. Organizational change</td>
<td>[27, 28, 30, 39, 24, 32, 39, 41, 34, 42]</td>
</tr>
<tr>
<td>H0. Managerial and technological challenge</td>
<td>[36, 37, 30, 43, 24, 35]</td>
</tr>
<tr>
<td>I0. Training and its effects on IT adoption</td>
<td>[27, 51]</td>
</tr>
<tr>
<td>J0. Socialization</td>
<td>[27, 28, 38, 31, 32]</td>
</tr>
<tr>
<td>K0. Capabilities development</td>
<td>[27, 28, 29, 30, 32, 39, 24, 26, 34, 42]</td>
</tr>
<tr>
<td>L0. Competitive advantage</td>
<td>[27, 28, 29, 30, 39, 24, 25, 26, 34, 42]</td>
</tr>
<tr>
<td>M0. Managerial decision styles</td>
<td>[27, 39, 24, 43, 40, 24, 35]</td>
</tr>
<tr>
<td>N0. Research and development</td>
<td>[25, 42, 35]</td>
</tr>
<tr>
<td>O0. Organizational roles</td>
<td>[27, 28, 36, 37, 30, 38, 40, 39, 31, 40]</td>
</tr>
<tr>
<td>P0. Competitive output</td>
<td>[37, 43, 39, 25, 26, 33, 41, 34, 42]</td>
</tr>
<tr>
<td>Q0. Managerial roles</td>
<td>[56, 37, 29, 43, 40, 32]</td>
</tr>
<tr>
<td>R0. Efficiency</td>
<td>[36, 43, 30, 39, 24, 33]</td>
</tr>
<tr>
<td>S0. Costs evaluation</td>
<td>[37, 44, 41]</td>
</tr>
<tr>
<td>T0. Selection</td>
<td>[32, 33, 44, 35]</td>
</tr>
<tr>
<td>U0. Diffusion</td>
<td>[30, 41]</td>
</tr>
<tr>
<td>V0. Strategy development</td>
<td>[28, 36, 37, 38, 43, 40, 39, 33, 34]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Marketing</th>
<th>Author(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1. Influence of performance</td>
<td>[45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55]</td>
</tr>
<tr>
<td>B1. Knowledge generation</td>
<td>[45, 48, 56, 54, 57, 58]</td>
</tr>
<tr>
<td>C1. Market intelligence</td>
<td>[51, 59, 56, 57]</td>
</tr>
<tr>
<td>D1. Efficiency</td>
<td>[45, 46, 50, 51, 59, 60, 54]</td>
</tr>
<tr>
<td>E1. Capabilities development</td>
<td>[47, 48, 49, 51]</td>
</tr>
<tr>
<td>F1. Partnership building</td>
<td>[47, 61, 63, 64, 65, 52, 59, 54, 57, 58, 55]</td>
</tr>
<tr>
<td>G1. Export intermediation</td>
<td>[45, 46, 64, 49]</td>
</tr>
<tr>
<td>H1. Acceptance and intentions of use</td>
<td>[47, 48, 49, 50, 62, 59, 52, 56, 57, 58, 55]</td>
</tr>
<tr>
<td>I1. Communication channels</td>
<td>[63, 50, 59]</td>
</tr>
<tr>
<td>J1. Integration</td>
<td>[51, 60]</td>
</tr>
<tr>
<td>K1. Decision making</td>
<td>[52, 56]</td>
</tr>
<tr>
<td>L1. Data visualization</td>
<td>[52]</td>
</tr>
<tr>
<td>M1. Virtual and electronic markets</td>
<td>[46, 63, 64, 51, 56]</td>
</tr>
<tr>
<td>N1. Comparative and competitive advantage</td>
<td>[62, 54, 57]</td>
</tr>
<tr>
<td>O1. Innovation</td>
<td>[45, 61, 48, 51, 56, 60]</td>
</tr>
<tr>
<td>P1. Internationalization</td>
<td>[46, 47, 63]</td>
</tr>
<tr>
<td>Q1. Social influence</td>
<td>[47, 52, 53, 54]</td>
</tr>
</tbody>
</table>

as the technology, people and the processes considered by Pearlson to add value to the use of IT [65]. Other concepts within this category are discussed by Chen, within the discussion of the need for a development of a shared view of the IT role within organisations. A view that is shared by business and IT leaders [66].

Authors within the Business Management article selection Parent expresses his concern on how to manage IT in order to set up a clear and communicated governance and at the same time avoid risk on the investment in new IT [36], while Black and McAfee refer to the management of IT, focusing on the investment risks within the use of it. The responsibilities on IT governance are assigned to the board of business directors and the CIOs. They are supposed to work closely together, considering IT governance as a main concern within their leading roles. CIOs and the board of business directors are expected to ensure an effective communication between each other [27, 30]. Malone emphasizes the need for a clear understanding of IT. Inhere the focus is set up on the strategic way of thinking that business leaders have, when they make up IT-related decisions [43], while Selart focuses on the intuitive and analytical skills of the leaders for making IT-related decisions[41]. Carr sees IT as a strategical challenge, that can imply investment risks, when IT investment does not turn into the expected results. Such risks should be considered in advance [37]. Nolan considers different
forms of governance for IT, by classifying it in terms of the strategical understanding firms have of their IT organisations, as factory, support, strategic or turnaround mode. Managing IT depends on the type of organisational situation and needs an organisation has on IT [38]. Ho and Daneels focus on capabilities development in organisations [42, 35].

**Implementation** Within the definitions of implementation in the IT research literature we focus on the one proposed by Cooper, who considers it the organisational effort directed toward diffusing appropriate IT within a user community. Further, Cooper considers topics such as initiation, adoption, adaptation, acceptance, routinisation and infusion elements that influence the implementation of IT [67]. Orlikowski has also discussed elements within this category, such as the introduction of new IT, the creation and its influence on the use, by analysing the relationship building between different organisational roles and their interaction.[68]

Within the Business Management article selection authors discuss concepts of implementation of new IT. Malone analyses how adoption and implementation of IT imply the need for organisational change [43]. Black studied a case, where he analyses the relations between medical doctors and technologists in an implementation of a new CT-scanning technology. Hereby, doctors and technologists learn the new technology, share their knowledge and make decisions on patients diagnosis considering the results of CT-scannings [27]. Pai analyses the need for organisational readiness and the development of IT capabilities, so that IT can be implemented. The development of IT competences and organisational readiness directly affect the quality of the implementation of new IT. In a study of the quality of e-business strategies within manufacturing companies in Taiwan, the quality of implementation directly affects the e-business performance [34]. Upton focuses on modularity of the implementations of IT, ensuring the success of every step and increasing the efficiency [40]. Min Kim, Parent and Glaser are concerned about the risk of investment on IT, where the introduction of new IT may not always deliver the expected results. Usually IT represents low operational costs, and enables cost efficiency and the fulfilment of business goals, but it can also turn into extra costs for the firms because of not reaching the goals set-up, the user not using the system or not satisfied with it, by that not levering the expected return on the IT investment [39, 36, 29]. Parent and Glaser consider that business and IT leaders should have an understanding of the need of an incremental introduction of IT into the firms daily operations [36, 29].

**Social interaction** Authors in the IT research literature, such as Trauth analyse computer-supported forms of communication, collaboration and coordination, which intend to facilitate and enhance the development of new working environments [69]. Pauleen has discussed the relationship between members of teams [70]. Within this category concepts such as the use of IT and mediation are covered. This includes some aspects that involve contextual elements, which
can change the perspective of the use of IT. Orlikowsky analyses the process of structuring the technology in use, referring to the processes that exist when individuals manipulate IT to accomplish their work and how it can be reproduced or changed in particular social contexts [68].

Within the Business Management article selection authors as Chan focus on the influence of IT on the design of workplaces, including the workplace hardware, the physical facility and focusing on the workplace software, the social interaction between different areas in an organisation. IT allows non co-located teams to work together virtually and at the same time increase efficiency [28, 31]. Authors express their concern on how socialization within virtual teams is different than within co-located teams. Within virtual teams there is no direct interaction of the team members [31, 32]. They have to adapt themselves to new communication forms, regulations and norms and develop their knowledge within the group. Authors identify differences on the relation existing between teams newcomers, who request information and provide new ideas and established members, who provide information and knowledge [32, 24]. Other researches focus on the analysis of the relation between the technologists and medical doctors, such Black, in the case of health institutions. When introducing new technologies physicians focus on the relations with the patients and not the technology and technologists focus on the technology working [27]. A main focus within this category is the interaction between different organisational roles [27, 32, 37]. Authors propose the need for an engagement of IT leaders on the active communication with business leaders [38].

**Competitive advantage** Regarding competitive advantage Porter and Millar have brought a definition used in the IT research literature. They define competitive advantage, as the abilities gained through attributes and resources to outperform competitors within the same market, regarding operational effectiveness, differentiation, lowering costs, innovation and research and development [71, 72]. The concept of competitive advantage has been discussed through the research as link between the value creation and distribution. The value created in an economic exchange, is what scholars have called competitive advantage. The value created has to be greater that if the firm would not be part of an economic exchange. This complements the perspective of Piccoli, who considers that IT enables companies to launch many and varied competitive actions [73].

Authors within the Business Management article selection propose how to approach concerns within competitive advantage. Greve proposes the diffusion of new technologies by differentiation [33]. Ho proposes ambidexterity in the development of technological and design capabilities. Ho, Daneels and Malone consider that businesses can get benefits from technological capability development [42, 35, 43] and Berry considers the investment on research and development departments (R & D) outside the company to develop IT capabilities [25]. Other scholars analyse the difference between older and newer firms innovation. Kotha finds out that bigger companies can generate innovations in a easier way and by
that gain competitive advantage [26]. Min Kim analyses the difference between generic or specific IT systems, where specific IT can help companies to differentiate from its competitors [39]. Daneels sets the focus on de-linking (recognizing the technological competence) and re-linking (serving the customers) to improve technological capabilities and generate innovation [35]. Mc Lean focuses on the music industry, where the use of IT has changed the industry and improved the diffusion of commercial music [44]. Table 3 shows the categories within Business Management.

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Governance and strategy</td>
<td>Establishment of a clear governance, which is supported by a good communication between CIOs and business leaders. They are responsible for the strategic decisions.</td>
</tr>
<tr>
<td>Implementation</td>
<td>Incremental process when implementing IT - training has an effect on the implementations. It implies organizational change and capabilities development.</td>
</tr>
<tr>
<td>Social interaction</td>
<td>The social impact on the use of IT. The socialization forms within co-located and non co-located teams and the share of information and knowledge.</td>
</tr>
<tr>
<td>Competitive advantage</td>
<td>Differentiation and diffusion of new products and the development of IT capabilities within the organization and on external R&amp;D departments as main sources of competitive advantage.</td>
</tr>
</tbody>
</table>

Table 3. Business Management categories description

3.2 Marketing categories

**Partnership** The IT research literature has covered concepts, such as the collaboration and the need to establish a close relationship between firms and suppliers, the establishment of partnerships as a result of efforts on establishing relationships that facilitate dialogue, understanding, trust and cooperation between the business and IT areas [71, 5] as covered by Porter and Feeny and Willcocks. Moreover, the relationship existing between clients and suppliers as has been discussed by Kern and Willcocks, here the focus has been set up on the management level and the behavioural characteristics of the parties involved within partnerships, which has been summed up into a model that compares the interactions between clients and suppliers [74].

Within the Marketing article selection Ruey-Jer approaches concerns within partnership and see IT as an enabler for establishing relationships between business-to-business on the market and the enhancement of their performance through the relationships with other firms and suppliers [47, 61]. Oeystein proposes that the establishment of partnerships with other companies helps to the generation of knowledge. The generation of knowledge impacts the ability to create products that differentiate from similar products offered by competitors [63]. Jayachandran, Ozimec and Kim consider that IT systems improve how the relationships with other firms and/or suppliers can be created, because they
offer information about the market, which is easier to access through different IT channels, such as internet, e-mail or the systems itself. IT offers information not only on the customers within the market, but also information about other firms and suppliers. Moreover, the use of IT allows direct access to the intermediaries through the IT systems [59, 52, 58]. Grewal considers community building as essential part of the IT governance on electronic markets [56], for example as part of the creation of relationships within the supply chain [58, 57] as proposed by Kim and Davis or Lee’s e-alliances [62]. Authors, such as Brady, Jayachandran and Davis consider IT an important factor in managing market information. IT allows an easier information flow, that generate knowledge and improves relationship building. IT improves information management, through the integration of the Marketing practice and the enhancement of the processes for managing the information [51, 59, 57].

**Performance** Authors within IT research, such as Porter, Weill and Rose and Li dicuss performance elements, such as efficiency, the need for decision making processes and entities and the generation of comparative and competitive advantage and integration and the impact of IT implementation on the performance of firms, in terms of how competitive they can be compared to the competitors on the market [71, 75, 76]. On the other hand, the relationship between the development of capabilities and firm performance has been analysed focusing on the identification of the resources that contribute to the generation of competitive advantage, such as IT infrastructure, human IT skills and IT-enabled intangibles. Bharadwaj considers the need for analysis of the inconsistent statistical findings about the relationship between IT and firm performance, so that it is possible to improve the understanding on the existing relation and the improvement possibilities [77].

Scholars within the Marketing article selection mention how IT systems, such as CRM have a direct impact on the performance of the firm. Ahearne proposes that IT systems can improve the efficiency on sales of products [45]. Andersen considers that IT can improve the efficiency and performance of export markets, because it offers a more direct access to the market, due to IT systems connected to the Internet [46]. Hunter considers that IT makes sales more effective [50]. At the same time, Ahearne, Hunter and Andersen identify challenges to the interaction between IT and Marketing areas. They are concerned about a new reality of the contemporary marketing, which includes the assimilation of IT [45, 50, 46]. Sundaram focuses on the enhancement of individual performance which at the same time improves the total performance of the firms [53], Ozimec considers that IT can improve decision making processes, because it allows a visual representation of e.g. the geographic situation on the market [52], Ruey-HJJer, Kim and Lee consider that firms are able to improve their learning from established relationships and at the same time improve their general performance, by the use of IT [61, 58, 62]. Di Benedetto analyses how technology transfer can generate new forms of perceiving IT and drive the development of capabilities to enable innovation within firms [48]. Brady, Nakata, Kim and Day found out that the
integration of IT within the Marketing area can be understood as a complementarity to generate innovation within the firms, so that they can react faster to the needs on the market and at the same time adapt to a contemporary reality, enable competitive advantage and enhance efficiency [51, 60, 58, 49].

**Acceptance/Intentions of use** The acceptance category focuses on concepts that have been studied by authors within the IT research literature such Davis, who has defined the acceptance as the perceived usefulness, perceived ease of use, the attitude toward using technology and the behavioural intention of using an IT system [78]. Cooper have discussed the importance of concepts such as adaption, acceptance, routinisation and infusion of IT [67]. Nevertheless within this category concepts, that have been discussed by Davis in terms of the technology acceptance model remain the main focus. The technology acceptance model presents the factors influencing the actual use of an IT system. It proposes links between external variables and the perceived usefulness and the perceived ease of use. At the same time the perceived usefulness has an influence on the behavioural intention to use IT and this last one ends up on the actual use of an IT system [78].

Scholars within our Marketing article selection raise concerns about acceptance. Homburg found out that the use of IT has a strong social influence at different levels within organisations. Sales managers will influence each other on the acceptance and perceived usefulness of IT. Further, they will influence the use, acceptance and perception of IT at sales level [54]. Sundaram focuses on the intentions of use of IT from the point of view of the frequency, how often a technology is used and the routinisation, how the technology is integrated within the daily work routine [53], Jayachandran on the effect of CRM systems use [59]. Di Benedetto focuses on extensions of the technology acceptance model (TAM) and considers that introducing new IT will not blindly be accepted [48]. Homburg and Sundaram discuss how the acceptance of IT in the Marketing practice enhances the individual performance and the firm performance. The social influence is reflected on the use at different levels within a company [54, 53]. Ruey-Jer focuses on the development of capabilities that enhance the way IT is used within organisations, the electronic integration of IT systems, IT human resources, such a system development and managerial skills and the development of complementary organisational resources such as flexible culture, strategic planning and supplier relation that can be developed to accept and use IT within the Marketing discipline [47].

**Internationalization** Within the IT research literature Ives and Javarpaa have considered the use of IT across platforms, cultural environments, businesses and channels [79]. At the same time IT leaders have recognized that the speed to the market is one of the main key issues for IT. Speed to the market enables firms to put products on the market faster with the help of IT [3]. Saraswat considers that the role of globalisation within the industrial and economic activities, has moved firms to re-think the international perspectives and move into
other territories to expand their positions and take advantage, which can lead to expand their opportunities [80].

Within the Marketing article selection some authors identify internationalization concerns, that can be approached with the use of IT. IT systems help to improve the direct communication with suppliers on the market, enabling a faster and more effective way to access suppliers on new markets. As it has traditionally been done using intermediaries on foreign markets [46]. Other authors focus on the use of virtual export channels and Internet, as main ways to expand to new markets [64]. Grewal considers that the use of IT requires also the implementation of new governance mechanisms for electronic markets, that include monitoring, community building and self-participation of the markets makers, to ensure the success in accessing new electronic markets [56]. Furthermore, while Morgan-Thomas focuses on export using virtual exports channels [64] and the improvement of relations on international markets [63, 47]. On the other hand, authors reflect that the use of IT may probably not totally replace the use of intermediaries, because of the need of social relations and interpersonal trust building. However, IT offers a feature for organising international transactions, which the marketing discipline can make use of. Andersen considers that the diffusion of IT within other areas may become more popular in the near future, as well as hybrid forms using already existing channels and a combination with IT [46], as proposed by Mathews can improve the generation of knowledge and contribute to internationalization processes [55].

Table 4 shows the categories within Marketing.

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partnership</td>
<td>Relationship building between businesses (competitors, suppliers) in the market with the use of technologies, such as CRM, SCM and GIS systems to support partnership building.</td>
</tr>
<tr>
<td>Firm performance</td>
<td>Impact of IT within the performance on individuals and whole organisations efficiency and effectiveness to the market and the gathering of market information.</td>
</tr>
<tr>
<td>Acceptance</td>
<td>Acceptance and intentions of use of IT and how the social relations have an influence on the intentions of use and perceive usefulness of IT.</td>
</tr>
<tr>
<td>Internationalization</td>
<td>Access to new markets through direct channels offered by IT, Internet, IT systems, virtual export channels and its use on export and internationalization processes.</td>
</tr>
</tbody>
</table>

Table 4. Marketing categories description

4 Concluding remarks

The purpose of this literature review was to find out the concerns about IT within the areas of Business Management and Marketing, to contribute to the alignment discussion. Despite our knowledge of the importance of the social dimension of alignment as analysed by Reich and Benbasat [2], we still know very
little about what it takes to reach to build a relationship between IT and business areas, that contributes to alignment. We argue that understanding better the concerns that have been identified within this paper, could be a way to better understand the relationship between IT and business leaders and the social dimension of alignment.

Within the practical implications we have that this literature review can help to understand how to establish a relationship between IT and business areas in practice. While in the Business Management article selection relationship building focused on the interaction between different organisational roles, discussed by Marler, Chan, Ahuja and Tippins [28, 31, 32, 24], within the Marketing article selection relationship building, focuses on the establishment of partnerships or e-alliances with different actors within the markets as discussed by Oeyestein, Kim, Davis and Lee [63, 58, 57, 62]. Understanding the concerns within Business Management, such as governance and strategy as stated by Black and Malone [27, 43], the development of capabilities analysed by Berry and Ho [25, 42], the social interaction analysed by Chan [28] or knowledge sharing within organisations as discussed by Ahuja and Tippins [32, 24] may help to improve alignment between IT and Business Management areas.

Within the research implications, the literature review and the obtained findings contribute to the better understanding of the analysis made by Reich and Benbasat on the social dimension of alignment between IT and business areas [10, 2] and the contextual elements that play a role on building the relationship between IT and business areas as discussed by Chong and Campbell [11, 14]. In order to be prepared to face the challenges that organisations have in regards of IT. Preliminary findings within this literature review suggest the importance of further studies within governance and strategy, competitive advantage and internationalization within Business Management and Marketing. The findings are the first step into a concrete representation of the concerns about IT within different business areas and the role of the different dimensions of alignment proposed by Reich and Benbasat and Chan [2, 8]. This can motivate future research works within the areas of concern.

This literature review has some limitations. The focus on only top journal publications narrows the pool of contributions to a smaller amount. Conference papers, in-proceedings and articles within other journals were not included. Furthermore, the criteria used within the selection of articles may exclude some contributions, because the keywords are narrowed down to a very specific selection. Future works within this topic could include other type of publications and some empirical data, such interviews, observations and surveys with stakeholders. This may improve the findings. Moreover, the number of categories obtained can be extended within Business Management and Marketing, as well as other business areas can be included to gain knowledge about the concerns about IT within other business areas.
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Table-top Exercises for Emergency Management: Tame Solutions for Wicked Problems

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Abstract. In response to large emergencies, emergency managers deal with unknown situations characterized by complexity and uncertainty, so called wicked problems. Existing table-top exercises are used to train, test and exercise emergency managers but do table top exercises mirror the wickedness? A pilot study where emergency managers were interviewed about the use of table-top exercises has been conducted. The pilot study and traditional table-top exercises are then analyzed through the lens of wicked problems. The result shows that table top exercises partly mirrors wicked problems but can’t handle all aspects of wicked problems. The main reasons are, the planning of table-top exercises where the problems and solutions are known in before tame the problems and the focus on the use of plans results in that unplanned problems will not be addressed. I propose three design principles to be used when designing table-top exercises to prepare the emergency managers better for wicked problems. First, let the participants tame the problems when solving them during the exercise instead of taming problems when planning for exercises. Second, focus on unsolved (wicked) problems instead of problems already handled in plans and let the participants identify them. Third, use existing plans and lessons learned from previous emergencies and resolve the problems in collaboration.

Keywords: table-top exercises, emergency, crisis, wicked, tame

1 Introduction

The aim with this work is to find design principles as a foundation for developing an Internet-based tool for table top exercises. Focus of the work is on the management level at command centre from where the response of the emergency is managed. Table top exercises are used for preparing emergency managers to respond on large scale societal emergency situation, several emergencies have characteristics of wicked problems (uncertain, complex, and with no obvious solution) in contrast to tame problems (simple or complex but possible to define solutions) [2]. For all emergencies there are a number of agencies participating in the response activities. Each of these have an emergency manager and one of them is appointed responsible for the whole operation, the incident commander. The incident commander’s task is to coordinate a number of agencies and other stakeholders with different capabilities to
create a temporary dynamic organization to adapt to dynamic, unique and uncertain emergency situations [1]. Incident commanders and emergency managers are facing situations that differ depending on the scale and type of emergencies from everyday response to larger response operation. Car fires, traffic accidents, and residential fires are examples of everyday responses. These problems are characterized by a consensus on problem definition and maybe also on solution, so called tame problems [9]. In larger response operations it is difficult to get an overview of the situation because of increasing complexity and uncertainty, several agencies and other stakeholders are involved in the response action, and it is difficult or impossible to plan for. Managing response operations in the event of emergencies like train accidents, forest fires are examples of larger operations. These problems are examples of wicked problems characterized by no agreement on the problem definition or its solution [9]. The wickedness increases if the emergency develops to a crisis or even worse a disaster, i.e. if the extent of the accident increases to cover more people and/or larger geographic areas with major personal and/or property damage.

Emergency management consists of four phases, mitigation, preparation, response, and recovery. This work concerns the preparation phase, preparing emergency managers to deal with emergencies in the response phase. The preparation is done in the emergency planning process which is a planning-training-exercising process. In the planning part the knowledge, skills, resources, and abilities that are likely to be needed during a given response are documented in a plan. From the plans it is possible to identify the needs of knowledge, skills, and resources to design training that fulfills the needs. Exercises can then use simulated accidents to test the overall capacity and test individuals’ knowledge and skills [3]. To plan for emergencies is a difficult task and the difficulties increase significantly when the complexity and uncertainty of the emergency increases [4], i.e. when the wickedness of the situation increases. Some of the problems are tame and some are wicked but organizations must prepare to manage all types of problems. This implies that this wickedness should also be reflected in exercises. The question to be answered in this work is: Do table-top exercises mirror wicked problems?

A number of authors agree on that managing of emergencies/crisis are examples of wicked societal problems and have done studies in the field. Stubbard [2] argues that crisis or emergency decisions are mainly non-routine or wicked problems and are characterized by uncertainty, complexity, conflicting interests, and ego involvement. The article discusses how to handle decision making in crises and conclude that there are no grand unifying framework for crisis response. Turoff [5] provide an overview of Emergency Preparedness and Management and discuss relevant theories, for example High Reliability Organizations and muddling through and gives recommendations to promote more effective planning, management, and response. Muddling through is an approach using incremental changes based on an understanding of the past, i.e. use solutions for similar problems and adjust them to the current situation [6]. O’Brien [7] argues that responding to “wicked problems” requires greater emphasis on pre-disaster planning driven by social learning processes where there is a need for having perceptions and understanding from all parties that might be involved. Plotnick [8] propose a model of an individual’s cognitive
responses to threat and review system design principles that can support flexible, adaptive responses in crisis. An approach for resolving general wicked problems are purposed by Roberts [9]. Roberts describes three different context dependent strategies, competitive, authoritative, and collaborative for coping with wicked problems. Huthinson [20] purpose a team based approach for the planning and solution of wicked problems. The team consists of individuals that have knowledge relevant to all aspects of the problem. This approach can be seen as an implementation of the collaborative approach. Conklin [10] argue that solving wicked problem is a process where problem solving and learning are tightly intertwined and that the flow of this learning process is opportunity-driven.

However, no one as far as I know has investigated how this theories, models, and strategies can be applied in table top exercises. The contribution of this work is to apply these theories, models, and strategies to come up with design principles for table top exercises to prepare the emergency managers better for wicked problems. The focus is on the situation with solving problems and not on individuals.

The rest of the paper is structured as follows: section 2 Research Process, 3 Wicked Problems and Emergencies, 4 Table-top Exercises, 5 The Pilot Case, 6 First Design Principles, and ending with section 7 Conclusions and Discussion.

2 Research Process

This article is part of a design research [11] project where the overall objective is to develop an Internet based table-top exercise planning and training tool that improves the emergency preparedness to handle problems with inter-organizational aspects in an emergency situation on management level. In order to accomplish this we need to identify existing problems and areas of improvement and formulate them as design principles for both the artifact and the exercise process. A literature study and an interview study were carried out. This paper forms the basis for formulating the problem and to come up with the first design principles for the project.

The result is based on literature for identification of related research regarding managing wicked problems in exercises. The literature review was carried out using the key words; table top exercises, wicked, training, planning. No delimitation was made regarding different fields to enable potential research from various fields. The empirical study is a pilot case where incident commander are interviewed about their opinion on table top exercises. The case is a community in Norrbotten Sweden. Four managers were interviewed; one each from the fire brigade, military services, health care, and railway company. All of the respondents have been in to the business for many years and have extensive experience of exercises. Thematic semi-structured interviews where used [12]. The theme of the interviews was table top exercises and the respondents were asked to give comments, changes, and improvements on exercises. The interviews were carried out on six occasions. The author took notes during the interviews. The theoretical description of table top exercises and the empirical data are then analyzed through the lens of wicked problem.
The concept of wicked problem has six characteristics: 1) The problem is not understood until after the formulation of a solution. 2) Wicked problems have no stopping rule. 3) Solutions to wicked problems are not right or wrong. 4) Every wicked problem is essentially novel and unique. 5) Every solution to a wicked problem is a “one shot operation.” 6) Wicked problems have no given alternative solutions [10] [13]. I will present the concept in more detail and exemplify it with problems in emergency situations.

1) The problem is not understood until after the formulation of a solution. The information needed to understand a problem is based on an idea of a possible solution. Solutions and understanding of the problem is linked. But the solution to a wicked problem turns up new problems that require an adjustment of the solution. This means that the problem must constantly be reformulated. It is only after a solution has been implemented the effects can be evaluated and the problem can be understood. What the problem is depends on who you ask. Different stakeholders have different views on what the problem is and different opinions on an acceptable solution. For this type of problem, there are often a large number of stakeholders [13] [10]. For example, a forest fire, there are many uncertain parameters that lead to the problem that is difficult to define and therefore difficult to know what operations (solutions) are required to manage the incident. Where did the accident occur? Are there any people in danger, if there are where are they located? What resources are available and from whom and when are they available? How is the weather condition now and later on? There are many stakeholders involved except for emergency services also landowners, property owners, non-governmental organizations (NGOs), businesses, and the public. Another aspect is the conflict of interests between stakeholders. The risk of conflict of interest increases with the number of participants in rescue operation. Emergency services give first priority to save lives and then property. Private organizations that are affected by the accident of personnel and / or property have a vested interest in their employees and property in the first place. Emergencies are therefore difficult to define and since they are difficult to define they are also difficult to come up with solutions for the problems [10].

2) Wicked problems have no stopping rule. Because the problem is not defined, it is not possible to define criteria that tell when the problem is resolved. Since there are an infinite number of solutions to the problem, the process will continue until the resources in terms of time, money, etc. ends and not because of a definitive solution to the problem is found [13] [10]. In for example forest fires, the action of fire fighting stops when the fire is extinguished but it can’t be pre-determined where and when the fire is extinguished. Emergencies in the short run, during the response, have stopping rules like forest fire been extinguished but in the long run, the recovery phase, has no stopping rule. We can’t tell when the damage of the forest fire is restored and/or the best way to do it. The limitation to the response phase is actually to tame the problem or to simplify the problem.

3) Solutions to wicked problems are not right or wrong. Solution quality can’t be determined objectively, but it is an assessment of stakeholders in terms of good or
bad, or good enough [13] [10]. If the decision was good or bad, or good enough can only be made in retrospect by stakeholders. In the case of forest fires, it is often many landowners involved who may have different opinions on how to fight the fire has been carried out, depending on how their properties have been affected.

4) Every wicked problem is essentially novel and unique. There are no two problems that are identical even though there may be a lot of similarities. The solutions to these will always be tailored to the specific situation [13] [10]. For example for a forest fire, it is very unlikely that it will start in the same geographical place and with the same weather conditions. Two forest fires have similarities like the recourses needed but depending on environmental factors they are very different.

5) Every solution to a wicked problem is a “one shot operation.” Every solution that has been implemented will have consequences. Once a solution has been implemented, there is a new context and the process of defining new wicked problems and possible solutions continues [13] [10]. As Conklin says “This is the “Catch 22” about wicked problems: you can’t learn about the problem without trying solutions, but every solution you try is expensive and has lasting unintended consequences which are likely to spawn new wicked problems.” It is not possible to test a solution to see if it works. When an operation is decided on, and efforts to extinguish the fire started, you can’t undo the operation. If the solution is bad then the new situation is another wicked problem to solve.

6) Wicked problems have no given alternative solutions. There may be no solutions, or there may be a number of possible solutions or a range of solutions that have never even thought of. It is a matter of creativity to design potential solutions, and a matter of judgment to determine which are valid, should be completed and implemented [13] [10]. As long as the fire is not extinguished the problem has to be reformulated depending on for example weather conditions. Which means that forest fires has an innumerable list of possible operations on the problem.

The definition of tame problems is the opposite of the characteristics of wicked ones; a tame problem has a well-defined and stable problem statement; a definite stopping point; a solution that can be objectively evaluated as being right or wrong; solutions that can be tried and abandoned; and belongs to a class of similar problems that can be solved in a similar manner [13].

Large scale emergencies have characteristics of wicked problems while small scale emergencies can be characterized as tame problems. From the definition of wicked problems and the characteristics of emergencies I can conclude that some of the problems that emergency managers are facing are wicked problems. Problems don’t need to have all the properties to be categorized as a wicked problem [10]. Fire fighting a forest is a problem with wicked elements but also with tame elements. I will use the characteristics of wicked problems when analysing the concept of table top exercises.
4 Table-top Exercises

Exercise is the generic term for a range of activities that test emergency response readiness, evaluate emergency response plans, assess the success of training, and development of plans. There are no definite definitions of exercises but they are usually categorized in two groups operation-based and discussion-based. Operation-based exercises include drills, functional exercises, and full scale exercises. They are used to test, train, exercise, and assess plans, policies, agreements and procedures. Discussion-based exercises include seminars, workshops, table-top exercises, and games. These types of exercises are used for training, exercising, assessing, and developing existing plans, policies, coordination, and procedures. Discussion-based exercises typically focus on strategic and policy oriented issues like coordination of agencies operations during emergencies [14] [15].

Table-top exercises are a discussion-based exercises used for preparing emergency managers. These exercises are used when different organizations need to exercise together on management level, not only authorities specialized for responding to accidents (Police, Fire Brigade, Health care, etc.) but also organizations like private companies, non-governmental organizations (NGOs), and military forces [14]. The participants may be from a single group or agency, or a diverse group of agencies.

There are two types of table-top exercises, simple and advanced. A simple table-top exercise is a facilitated analysis of an emergency situation in an informal, stress-free environment. It is designed to obtain constructive discussion as participants examine and resolve problems based on existing operational plans and identify where those plans need to be refined. The purpose is to train and exercise coordination arrangements and to teach participants how all the elements fit together and if necessary improve plans. Equipment is not used, resources are not deployed, and time pressures are not introduced. The exercise is led by the exercise manager, who triggers the scenario and makes sure that all key points are brought out. There is a prepared list of problems or events which each agency is expected to respond on. The different agencies are together in one room. The exercise manager is also in the same room and can in real time follow and assess how the scenario and the response develop. Information about the scenario is delivered through paper or verbal requests and each agency use their own plan and their way of solving problems to respond to the emergency. Written problems and related discussion questions can be given to individuals to answer from their own perspective and then discussed in group. Improvements in the plan can be introduced if necessary. There is variation of the exercise. The agencies can initially be organized in separate rooms and then brought together to negotiate and conflict each other to explore difficulties of collaboration between different agencies. [16] [14] [17] [18] [19]

An advanced table-top exercise or simulation exercise is a simulated interactive exercise that helps to test the capability of an organization to respond to a simulated event. It is a coordinated response to a situation in a time-pressured, realistic simulation that involves several agencies. An advanced table-top exercise focuses on the coordination, integration, and interaction of an organization’s policies, procedures, roles, and responsibilities before, during, or after the simulated event. It places heavy
emphasize on communication between all the agencies participating in the exercise. This type of exercise requires much more planning, preparation, and coordination than a simple table-top exercise. The agencies are gathered in a coordination center. Exercise managers are in a separate area and run the game through paper feeds and through phone or e-mail requests. The information communicated to the participants is a sequence of events determined in advance. These messages can expand or alter the accident or be consequences and reactions from the outside world. The participants are supposed to make decisions in real time to these messages. If participants do not act like it is supposed to, exercise managers can create new messages to force the participants to act. The exercise is carried out without any discussion or retakes of the course as a failure because time is an important aspect of the exercise.

In an advanced table-top exercise participants are grouped in their own organizations or in functional groups, policemen together, etc. and separated from each other. The groups can use their own command center or contractor for support during the exercise. Documentation is done during the exercise usually by the participants themselves. The exercise will be analyzed and feedback is done after the exercise is completed. There are variations of the exercise. It could involve an element of competition between groups. Then there is no interaction between the groups and all communication is with the exercise manager. Another variant is to let all communication between the groups go via the exercise manager to monitor the performance and group dynamic.

5 The Pilot Case

The respondents have the opinion that their own organization works rather well in emergency responses but there are needs to improve the inter-organizational coordination. The health care respondent pointed to a need for exercises for internal coordination. The reason for this view is that health care is divided into many special features that are geographically dispersed and the contact between them for dealing with accidents must be strengthened.

The respondents agreed on that table top exercises are mostly used for exercising and drilling plans in their own organization and for that purpose it works well. One respondent exemplified it with “Test plans, such as testing the evacuation of our control center.” Validating and testing of plans are also used but only organization’s own plans and not for inter-organizational coordination during the exercises. One respondent had a desire for additional table top exercises “The usefulness of the exercises is too small. I would like to have short inter-organizational collaboration exercises where participants will discuss shared problems that you face.”

The exercises are rather predictable as a respondent expressed it “I have participated in many exercises and there is rarely anything new that is supplied. Most of the times you practice what you already know.” Another respondent expressed it like “You know how it is planned and you know what will happen in the exercise.” A third respondent believed that one should prepare for the exercises and focus on...
certain areas. “Give homework with the action scenario. Identify key events/decisions of the scenario to be addressed from an integrated perspective that can be discussed during the exercise.”

The respondents agree on that there is a need for improved knowledge of other participants, contact persons, available resources, expertise, plans, etc. One respondent expressed it like “It can be done by participants in table top exercises that are brought together in conversation discussions in an active way.” Developing of personal relationship is fulfilled depending on that this types of exercises often are placed at conference facilities where participants socialize before and after the actual exercise.

Another important aspect of exercises is who from the organization will participate in the exercises if plans and knowledge shall be developed in the exercises. “It is important that right people participate in the exercises. High enough level to be able to change plans but right level to know the area.” Feedback to the organization is also a problem that has to do with who is participating in the exercise. As one respondent expressed it “In large part, it is only the participating members receiving knowledge.”

6 First Design Principles

I propose three design principles to be used when designing table-top exercises to prepare the emergency managers better for wicked problems, see table 1, based on the lens of wicked problems and practical issues in the empirical data.

<table>
<thead>
<tr>
<th>Design principle</th>
<th>Implied by</th>
</tr>
</thead>
<tbody>
<tr>
<td>First, let the participants tame the problems when solving them during the exercise instead of taming problems when planning for exercises.</td>
<td>Wicked aspect 1 and empirical data</td>
</tr>
<tr>
<td>Second, focus on unsolved (wicked) problems instead of problems already handled in plans and let the participants identify them.</td>
<td>Wicked aspect 3, 6 and empirical data</td>
</tr>
<tr>
<td>Third, use existing plans and lessons learned from previous emergencies and resolve the problems in collaboration.</td>
<td>The concept of muddling through and the collaborative strategy</td>
</tr>
</tbody>
</table>

Table 1. Design principles

The First design principle is implied by the first aspect of wicked problem and by the pilot case. The first aspect of wickedness “The problem is not understood until after the formulation of a solution” can’t fully be handled in table-top exercises. The emergency dealt with in table-top exercises, what should be practiced, and what should be achieved with a specific exercise is predetermined. There is a prepared list of problems or events which each participant is expected to respond on. The participants are supposed to use their own plans to act on the instructors messages. The use of plans to solve tasks during exercises is a limiting factor because they only cover problems that can be planned for, but what about situations that can’t be planned for? Exercises need to handle even these situations. This means that the
problems and solutions to the problems of table-top exercises are known in advance by the instructors and by developer of exercises. Participants do often know in advance the purpose of the exercise, when and where the exercise will be implemented, and how long it lasts. Wicked problems can by definition never be described or resolved fully which means that problems are tamed in before when planning for the exercise. But solving wicked problems are always about taming the problem. So the question is who should tame the problem, should it be the planner or the participant in the exercise? I believe that the participant should tame the problem to learn how to act in a real situation.

The Second principle is implied by the third, the sixth aspect of wicked problems, and by the pilot case. The third aspect of wicked problems,” Solutions to wicked problems are not right or wrong.” can’t be fulfilled with table-top exercises. It follows from the discussion above that the instructor knows the problems and has a solutions to it. But also the focus on using plans to come up with solutions which imply that only problems that are planned or can be planned for are practiced. The instructor can also use messages to have the participants to act on specific events in a predetermined direction which in some sense means that there exists some kind of solution. Emergencies that have workable plans can’t by definition be wicked which means that the focus should be on emergency scenarios that do not have plans, i.e. unsolved problems. If they don’t have plans does not mean that they are wicked but they still need to be handled. The sixth aspect of wicked problems, ”Wicked problems have no given alternative solutions.”, can’t be handled in table-top exercises in the way they exercises are planned. In order to create a situation in which the participants are forced to be creative to find solutions and use their judgment to select among solutions is simplified if the problems are unsolved, i.e. there are no plans for the problems so neither the participants or the instructor of the exercise have solutions. Allowing participants, according to a given scenario, identify unsolved issues is an aspect derived from the empirical data. It has to do with the predictability of exercises and that they often practice issues that the participants already know. There must be a focus on unplanned problems if exercises should be able to handle wicked problems. I also think if the participants are involved in identifying issues to handle during the exercise the predictability will be reduced due to the uncertainty of other participants’ problems.

The Third principle is derived from the approach of muddling through and the collaborative approach to solve wicked problems. Since the emergency managers have experience of accidents and the organizations they represent usually have plans for responding to accidents of various kinds the muddling through approach seems to be an appropriate choice [8] [6]. Approaches for solving wicked problems are seen as a matter of teamwork and as a social phenomenon [10] [20], therefore I believe that a collaborative approach [9] is a suitable choice to use when designing table top exercises for managing wicked problems. There is time to handle problems in the preparation phase, unlike the response phase, which also supports the choice of the collaborative strategy. I think that there has to be some strategy for managing these types of problems and that learning how to use these strategies is one part of dealing with wicked problems.
Wicked aspects 2, 4 and 5 have not been used for developing the design principles. The second aspect of wickedness, “Wicked problems have no stopping rule.” is not handled in table-top exercises. This aspect has not been used for developing the design principles since it depends on simplification or taming of the problem to be limited to only the response phase. The response phase has two overall objectives rescue people and then save property. The goal is achieved when the fire is extinguished or when injured people are transported to hospitals, whether the problems have been solved in a good or bad way.

The forth aspect of wickedness, “Every wicked problem is essentially novel and unique.” is possible to fulfill with table-top exercises because it is always possible to create new scenarios with new conditions. Therefore, this aspect has not been used for developing the design principles. The same type of accident, such as a train accident, can be used several times since it is possible to change the conditions such as the seasons, weather conditions, geographic location, type of train, etc.

The fifth aspect of wickedness, “Every solution to a wicked problem is a “one shot operation””, is possible to handle in table-top exercises. This aspect focuses on the fact that actions taken can’t be undone and will create a new context, i.e. new problems to solve. The accident in the form of a scenario in the exercise can be constructed so that no participants in advance can establish criteria for when and how the task should be resolved so that the process of reformulating the problem persists, i.e. to develop new solutions to the problem. This kind of changes requires improvisation from the instructor because is difficult or impossible to plan in advance for all possible decisions that can be made.

7 Discussion

This article contributes by showing that table top exercises don’t mirror wicked problems fully and by suggesting three design principles to prepare emergency managers better for wicked problems. From the result I can draw the conclusion that table top exercises partly mirrors wicked problems but can’t handle all aspects of wicked problems. The concept of wicked problems identifies two main reasons. First, planning of table-top exercises where the problems and solutions are known in before tames the problems. Second, the focus on the use of plans implies that unplanned problems will not be addressed and some of these problems may be wicked. The planning of table top exercises must therefore be changed to be able to include problems with wicked aspects. Exercises that handle problems with wicked aspects can also manage tame problems. The reason is that wicked problems must be tamed in order to be solved, which means that it is about solving more or less tamed problem. The challenge with wicked problems is to tame or limit them so that they can be resolved.

The proposed design principles to better manage wicked problems focus on this issue. The first design principle suggests that problems should be tamed during the exercise by the participants instead of being tamed in the planning phase. This implies that planning of table top exercises has to be changed to focus more on problems than
on the solutions. The second design principle suggests that focus should be on unsolved problems and let the participants come up with problems themselves. This implies that exercises can’t be planned as a sequence of predetermined events that is responded on using a plan, since there are no plans/solutions to these problems. The third design principle focus on how to deal with wicked problems by using existing plans and lesson learned from previous emergencies to solve problems in collaboration. This principle don’t is most suited for the simple exercise because it is used more for training and planning, and it can use discussions and does not have the same time pressure as the advanced type.

The intension with this work was to find design principles as a foundation for developing an Internet-based tool for table top exercises but they can also be used by practitioners to complement traditional table top exercises. Further research could be to implement the suggested design principles above to improve table-top exercises to prepare emergency managers better for wicked problems.

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Pilot Design of a Survey Instrument for Assessment of Assistive ICT Initiatives

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Abstract. In most parts of the Western world, we are seeing a growing population of elderly. Health factors can pose barriers to independent living for this population. Several municipality based projects are seeking ways to address the needs of this diverse citizen segment. Use of ICT in the home may allow for longer independent living for elderly. In prior research we proposed a framework for assessment of projects targeting the use of ICT for independent living for elderly. Additionally we recommended assessment criteria to account for environmental contextual factors and for Quality of Life factors among the elderly [1]. We briefly present this framework in this paper and extend this work by designing a survey instrument. We describe a pilot project and discuss how our survey instrument may be applied as part of the assessment of the project.

Keywords: assistive living, ICT, Quality of Life, wellness and safety technologies

1 Introduction

In light of a growing population of elderly, municipalities in the Nordic countries and in many other countries across the Western world are seeking ways of addressing the diverse needs of the segment. Many communities are funding programs that design and develop a variety of information communication technologies (ICT) intended to improve the Quality of Life (QoL) of these elderly citizens. The stakeholders in such programs are diverse and include the target elderly citizen population, their relatives, health and care workers, political entities and technology vendors. The latter group is often the most proactive in pointing out possible advantages of adoption of their ICT technology solutions. In the interest of avoiding an imbalanced assessment of such technologies, due to possible stakeholder bias, we suggested in [1] that present and future initiatives could benefit by the application of an evaluation framework that accounts for QoL factors as well as project specific contextual factors. This paper extends the former work by designing a survey
instrument for assessment of a pilot project for independent living for the elderly. Secondly we propose a strategy for the administration of the survey instrument.

2 Background Literature and Theory

The adoption of ICT technologies in the home, such as computers and Internet access, have achieved high rate of acceptance among the elderly in the Western world, including the Norwegian society. Over the last 6 years the proportion of people in Norway in the age group 65-74 that has used a PC and Internet on an almost daily basis, has more than doubled, in this age group 45% use a PC and 39% use Internet daily or nearly every day [2]. We expect this group will continue to be PC and Internet users as time goes by and they get older, hence we expect a high increase in net users among the elderly. Mobile devices with new and easy to use interfaces have also successfully penetrated the market of senior citizens [3]. Hence we can expect that senior citizens will be ready to adopt technology for assisted living to an increasing degree.

2.1 Challenges of elderly and choices of Assistive Technology

What are the challenges faced by elderly and what are the current choices? The challenges vary considerably [4], although a public report for the Norwegian Health ministry [5] suggests focusing on three issues; fall prevention and detection, communication technology and wander management systems (using geographic positioning systems or GPS technology). There are also other challenges that senior citizens living at home may face such as lack of nutrition, difficulties in managing opening doors, heating, communication with medical staff and family etc.

A SINTEF (the largest independent research organization in Scandinavia), project on assistive technologies for houses and apartments [6] reports a number of possibilities. These include smart homes with sensors for temperature, lights, opening doors, sensors monitoring movement and falls, systems for monitoring and advising on issues related to health and diseases (e.g. diabetes and malnutrition) and GPS’s for people with cognitive dissonance (dementia). Both this report and the NOU 2011:11 base their division on the Center for Aging Service Technologies´ work [7], see Table 1 for an overview.

One of the challenges is to select a portfolio of equipment that elderly can get access to as the need for assistive technology occurs and possibly gradually increases [8]. There are several challenges related to this including issues concerning financing, standardization and integration, implementation in a health care setting and keeping track of technologies and their application. There is very little prior research on effects of assistive technology for elderly in need of care, while living alone, however we will briefly refer to some work in this area.

A thorough literature review of 89 trials including 97,894 people found that complex interventions can help elderly people to continue living at home, largely through prevention of the need for nursing-home care, and can help to reduce the rate
of falls [4]. Their results indicate substantial variation in needs, the format of care, involvement of health-care professionals, and site of care provision and intensity.

A study of 18 elders with ambient intelligent system installed in their dwellings in Holland, found that the new technologies contributed to a greater sense of safety and security at home, feelings that were shared by the relatives [9]. However the study does not take into account many of the Quality of Life domains [10] such as emotional wellbeing, personal development, self-determination and social inclusion.

Table 1. Overview of categories of aging services technologies.

<table>
<thead>
<tr>
<th>Category</th>
<th>Technology type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety technologies</td>
<td>- Wander management systems (Targeted for dementia that may forget their way back home)</td>
</tr>
<tr>
<td></td>
<td>- Mobility aids</td>
</tr>
<tr>
<td></td>
<td>- Fall detection and prevention technologies</td>
</tr>
<tr>
<td></td>
<td>- Stove user detectors</td>
</tr>
<tr>
<td></td>
<td>- Smoke and temperature monitor</td>
</tr>
<tr>
<td></td>
<td>- Door locks</td>
</tr>
<tr>
<td>Health and wellness technologies</td>
<td>- Wellness monitoring technologies (Sensor based technologies, designed mainly for self-managed fitness/wellness applications)</td>
</tr>
<tr>
<td></td>
<td>- Telemedicine and telehealth</td>
</tr>
<tr>
<td></td>
<td>- Medication compliance technologies (Monitoring, reminding and dispensing patients of their medication)</td>
</tr>
<tr>
<td></td>
<td>- Cognitions technologies (for stimulation and entertainment, assessment and reminding)</td>
</tr>
<tr>
<td>Social connectedness technologies</td>
<td>- Phones, cell-phones and video-phones</td>
</tr>
<tr>
<td></td>
<td>- Internet-connections with easy-to-use interface with e-mail etc.</td>
</tr>
</tbody>
</table>

In a systematic review of studies of interventions to enhance the Quality of Life of older people in residential long-term care, 35 articles are assessed on issues such as study design, quality of the studies, measures of QoL and effects on QoL [11]. The study finds that most of the papers are low on methodological quality, and the instruments used to measure QoL were diverse. The interventions were often rather limited, whereas QoL is a multidimensional concept, which may explain the lack of a systematic effect on QoL across the studies.

2.2 Defining Quality of Life

Quality of Life (QoL) is an umbrella conceptualization that refers to wellbeing across multiple domains. QoL conceptualization in principle has both subjective and objective components, is based on individual needs and is composed of multidimensional constructs influenced by relationship and environmental factors [10]. While an in depth review of QoL domain cannot be presented in this paper, former research has informed our framework. Briefly, no consensus exists on how
QoL should be defined. Within each of the identified domains, there can be a number of factors that contribute to the evaluation. One example is the domain of emotional wellbeing. It may include a number of contextual factors, among these safety, independence, self-mastery, freedom from stress and satisfaction [12][13][14][10][15].

A part of our QoL framework is presented in Table 2 [1] (Moe & Molka-Danielsen, 2012). We have not included macro-level factors from our framework in this paper and refer readers to the aforementioned study. The macro-level factors are of broader environmental scope (such as community level) and as such are usually outside the control of the project management, and so are not addressed in the proposed survey instrument.

The analysis framework was based on the core domains of Schalock and Alonso [10]. According to Agee and Freedman [12, p. 1781]: “QoL measures can be objective measures of goal attainment or subjective perceptions of users.” Researchers who examine the use of assistive technologies have predominantly used subjective measures in defining the success of assistive devices [10]. We have included both subjective measures in our QoL framework.

Table 2. QoL Assessment Framework for Assistive Technologies for Independent Living.

<table>
<thead>
<tr>
<th>QoL Domains</th>
<th>Micro-level individual factors</th>
<th>Meso-level (program and ICT support) contextual factors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Emotional Wellbeing</strong></td>
<td>Contentment, satisfaction, mental-stress, self-concept, happiness, trust</td>
<td>Safety support integrated, freedom from self-monitoring</td>
</tr>
<tr>
<td><strong>Interpersonal Relations</strong></td>
<td>Friendships</td>
<td>Interactions, social support</td>
</tr>
<tr>
<td><strong>Material Wellbeing</strong></td>
<td>Standard of living (alone, assisted at home, care center), income, possessions</td>
<td>Housing standard (old, new), existing ICT supports</td>
</tr>
<tr>
<td><strong>Personal Development</strong></td>
<td>Living skills, personal competence</td>
<td>Rehabilitation program, self-mastery, augmentative technology</td>
</tr>
<tr>
<td><strong>Physical Wellbeing</strong></td>
<td>Health status, nutrition status, mobility</td>
<td>Sensors to monitor home environment, personal movement, and nutrition levels</td>
</tr>
<tr>
<td><strong>Self Determination</strong></td>
<td>Autonomy, self-direction, personal control, preferences, choice</td>
<td>Personal controls, planning controls for the home environment</td>
</tr>
<tr>
<td><strong>Social Inclusion</strong></td>
<td>Access and participation in communities of friends, family, supporters</td>
<td>ICT supports for community access and participation, status checks,</td>
</tr>
</tbody>
</table>
integration of ICT within home

| Rights                      | Privacy, personal freedom, sense of dignity | ICT supports self-control, responsibility, protection of individual rights |

Note. This table is based on Table 4 in Moe & Mølka-Danielsen, [1].

The stakeholder groups are described in the next Section 3 along with a description of the pilot project.

3 Lister Region: Independent Living Projects

Most of the Lister region has been running projects on assistive technology since 2011. The Lister region is a network of 6 collaborating municipalities on the south-west coast of Norway. These are in many ways typical Norwegian communities, the biggest municipalities having a population of close to 9 000. The municipalities have a thriving collaboration on several issues, including health services for patients that are sent home after hospitalization.

The project “Longer in own life” runs from 2011 to 2015 and has the overall goal of assisting in independent living through use of smart homes or technology in individual homes. This project has served as a demonstrator of assistive technology and two demonstrator apartments are up and running. One is a new apartment tailored to the need of elderly, whereas the other is an existing apartment that has been in use for years. The new apartment opened for more flexibility as it could be wired using different technologies; the older one is based on wireless technology.

The technologies installed are mostly fairly basic and include a system for controlling lights, heating and oven so that the inhabitant can make sure that everything is switched off by pressing one switch when leaving the apartment (or while in bed). They also include items like an alarm on the refrigerator so that medical staff or relatives can see if the inhabitant has used the refrigerator and remembered to eat. Medical dispensers to help control the intake of medicine are displayed, and there are Internet connections with easy to use interface for communication.

During fall 2012 assistive technology is implemented in 7 rooms with technology which is tailored to the individual patients in one nursing home. Implementations in two other nursing homes are planned for spring. The municipalities adopted a menu based system where they select the appropriate services for each patient from options including fall detection, wandering, fire alarm, light management and two way communications between patients and staff. One of the implementations will be in a rehabilitation department with 9 patients, whereas in the other will be a department with 30 regular patients. Our survey instrument will be tested in these 2 projects.
4 Methodology for Survey Design and Administration

Our literature review provides background and informs our survey design. The literature search in the prior sections was conducted in Google Scholar and Science Direct, using the keywords quality of life assessment and assistive living / independent living. The survey design is based on the previously developed QoL framework and is informed by its categories (presented in table 2 of this paper), that adopts a multi-part design focusing on micro- and meso-level factors.

The survey questions make reference to the WHO (1996) survey instrument [16]. The objective of the survey is that a micro-level inquiry of elderly users (recipients of assistive ICT) will reveal the elderly recipients’ individual attitudes of their wellbeing. The second part of the survey will inquire among a larger group of stakeholders to include elderly living alone, relatives and care workers. Questions chosen should be based on the contextual factors of systems and technology of the project. The basic structure of the questions is described in Section 5. The questions will be modified for each project context. We propose the project leader can later look for a correlation between individual assessment and contextual.

The methodology for the selection of the basic “types” of questions is as based on the following rationale.

• Questions from the WHO-questionnaire that were selected to address the QoL domains as listed in Table 2. The WHO questions that were selected are highlighted in “grey” in the Table in the Appendix. Other questions were left out of our survey design because we feel they address a broader assessment of QoL that goes beyond the expected impact of the ICT projects. For example, question 12 in the Appendix “have you enough money to meet your needs?” is a question about financial resources in the environmental domain. This would not be a relevant question for assessment of the ICT projects where resources are already given out freely for the project.

• The WHO-questions were categorized into the framework categories on the basis of how well they were a match for the QoL category. For example, QoL category “emotional wellbeing” has the factors of “contentment, satisfaction, mental-stress, self-concept, happiness, and trust.” We found the WHO questions G1 (how do you rate your quality of life?) and 5 (how much do you enjoy life?) and 6 (to what extent do you feel your life to be meaningful?) under the psychological domain also addressed the issues of contentment, satisfaction, and happiness.

• However, the WHO-questions did not address all of the factors within our QoL framework. Again, looking at the example in the prior bullet point, the questions did not address issues of mental-stress, self-concept, and trust. We then developed additional questions to address individual factors and contextual factors that were not addressed by the WHO survey.

• We found the WHO survey in particular only addressed some of the individual factors, and did not address contextual factors. Therefore, most of our additional questions fall under the category of contextual factors.

• One limitation of our methodology of developing a new survey instrument is that the validated calculation instructions on the WHO survey could (if adopted) have been used to get validated results. However, as we explained
above, the WHO survey does not cover all of the individual factors and covers none of the contextually specific factors. Also, we discuss the administration of the survey through interview in later sections. It follows; we suggest a qualitative analysis of the descriptive narrative will give more meaningful evaluation.

The next Section 5 presents the QoL survey instrument design and recommendations for administration. We suggest a two part survey is needed. Part one should address the micro-level factors of Table 2. Part two should address the meso-level factors of Table 2. The authors claim that the macro-level factors are largely outside the control of such projects, and are not addressed in the proposed survey instrument.

## 5 Proposal for the Survey Instrument

The World Health Organization has developed a QoL assessment instrument that focuses on the individual wellbeing beyond simple aspects of health care to provide more holistic feedback of health and health care. They define QoL as:

*Quality of life is defined as individuals’ perceptions of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns.* [16, p. 5]

The WHO assessment instrument denotes four domains: 1. Physical health, 2. Psychological, 3. Social relationships, and 4. Environment. Two questions are general questions of wellbeing (Q1 & Q2), questions 3-26 produce a scoring within domains. The 26 questions are provided in Appendix 1 with assignments of the domain of the question. The questions numbers are denoted in parenthesis in the second column of Table 3. The WHO QoL assessment instrument (1996) has helped to inform the formation of our survey instrument. Our questions for Part 1 and Part 2 of our survey are listed in columns 2 and 3 in Table 3.

### Table 3. QoL Survey Instrument: Individual and Contextual Factors.

<table>
<thead>
<tr>
<th>QoL Domains</th>
<th>Survey Part 1 Individual factors</th>
<th>Survey Part 2 Contextual factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emotional Wellbeing</td>
<td>Contentment, satisfaction, mental-stress, self-concept, happiness, trust</td>
<td>Safety support integrated, freedom from self-monitoring</td>
</tr>
<tr>
<td></td>
<td>• WHO (5, 6)</td>
<td>• Do you trust that you can call for help and be heard when needed?</td>
</tr>
<tr>
<td></td>
<td>• Do you feel afraid when alone?</td>
<td>• Does use of monitoring technology in your home help you enjoy life?</td>
</tr>
<tr>
<td></td>
<td>• WHO (G1)</td>
<td>• Does use of technology in your home make life more meaningful?</td>
</tr>
<tr>
<td>Interpersonal Relations</td>
<td>Friendships</td>
<td>Interactions, social support</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>• WHO (20)</td>
<td>• Do you have daily individual communication through technology with your friends, family, support staff?</td>
<td></td>
</tr>
<tr>
<td>• WHO (22)</td>
<td>• Does communication technology help you in your personal relations with family, with support staff?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Material Wellbeing</th>
<th>Standard of living (alone, assisted at home, care center), income, possessions</th>
<th>Housing standard (old, new), existing ICT supports</th>
</tr>
</thead>
<tbody>
<tr>
<td>• WHO (23, 24)</td>
<td>• How satisfied are you with your access to health services through ICT?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Personal Development</th>
<th>Living skills, personal competence</th>
<th>Rehabilitation program, self-mastery, augmentative technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>• WHO (13, 14)</td>
<td>• How available is technology for access to your day-to-day information technology needs?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Does ICT give you more opportunity for leisure activity?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Physical Wellbeing</th>
<th>Health status, nutrition status, mobility</th>
<th>Sensors to monitor home environment, personal movement, and nutrition levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>• WHO(G2, 3, 4)</td>
<td>• Do monitors in the patient’s home help you to determine if the patient is eating well?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Does technology help you avoid disturbances or worries in your sleep?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Self Determination</th>
<th>Autonomy, self-direction, personal control, preferences, choice</th>
<th>Personal controls, planning controls for the home environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>• WHO(3, 15, 17)</td>
<td>• Does welfare technology help you to get around in your home?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Does welfare technology help you to perform your daily living activities (cooking, cleaning, personal hygiene)?</td>
<td></td>
</tr>
<tr>
<td>Social Inclusion</td>
<td>Access and participation in communities of friends, family, supporters</td>
<td>ICT supports for community access and participation, status checks, integration of ICT within home</td>
</tr>
<tr>
<td>------------------</td>
<td>---------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>(WHO: 20, 22)</td>
<td>Do you use Internet based social media tools (such as e-mail, Facebook or Skype) to have access to your network of friends and family and support staff?</td>
</tr>
<tr>
<td></td>
<td>How satisfied are you with your access to your network of friends, family, support staff?</td>
<td>If so, how often do you use social media tools?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Does it help?</td>
</tr>
<tr>
<td>Rights</td>
<td>Privacy, personal freedom, sense of dignity</td>
<td>ICT supports self-control, responsibility, protection of individual rights</td>
</tr>
<tr>
<td></td>
<td>(WHO: 8, 13)</td>
<td>Does welfare technology help you to get information on your rights?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Do you feel welfare technology is invasion of your privacy?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Does welfare technology improve your sense of personal dignity? Or does it harm it?</td>
</tr>
</tbody>
</table>

### 5.2 Administration of the Survey Instrument

This section suggests the usage method for the survey instrument. We propose administration of the survey design based on non-probability sampling techniques as the population of elderly in the pilot project is a specific cluster or group of persons living in a nursing home. This group may not be representative of a broader elderly population. Secondly, some persons within the pilot project may not be available as respondents due to health related reasons. Lastly, time and resources for collection of the samples will limit the number of persons that can be asked to participate [17]. A limitation of non-probability sampling is that there is an assumption that there is an even distribution of characteristics within the population, but one cannot verify that a general population is represented.

The sample will be collected through purposive sampling technique through expert choice of those who will administer and run the survey instrument. In purposive sampling judgment is used by the experts, who will select respondents they believe possess the necessary attributes of the target segment. In this study our expert is the local project manager who will select respondents from three stakeholder groups including: elderly persons living in the experimental units, relatives of persons living in experimental units, and professional staff working in the nursing homes. The
purpose of our sampling will be to provide descriptive information on the attitudes of the stakeholder groups.

The survey instrument in the form of semi-structured questionnaires should be administered as face-to-face interviews in the native language of the elderly patient. The patients, relatives and health care workers need to be informed on the motivation for survey, terms and on some of the applications of the technology. More specifically, the interview participants will need to be informed during the interview on the meaning of certain terminology. For example, what is “ICT”, “monitoring technology”, and “welfare technology”. These words will be made clear with examples and by pointing to the technology in the homes in the case study at the beginning of the interview session. In the survey questions in Table 3, these terminologies are just “markers” to be filled in with context specific meanings. So the actual “list of questions” will be refined for each project.

These project specific terminology needs to be explained, to help participants reflect on what they know and use. Caution is recommended in the interview process as there is a risk of imposing a bias towards technology determinism on the respondents, they might feel they are expected to tell a story of assistive technology improving their quality of life. In summary, the questionnaires need to cover the same issues or domains, but we will need to tailor them to the stakeholder groups, patients, relatives and support staff.

Finally, this paper does not assess an administration of the survey instrument in an actual project. This is suggested as a next step in our research. The University of Agder is associated with the prior mentioned Lister region project as an evaluator of the project. The authors therefore intend to pilot the survey instrument in the autumn 2013.

6 Concluding Remarks

This article has presented the design of a survey instrument for assessment of a project using assistive living technology for independent living. An important approach to the design of the instrument is consideration of the stakeholders. We see three stakeholder groups as contributing to the assessment; patients, relatives and health and care workers. The questions were informed by the WHO survey instrument. Our survey instrument consists of two parts; one part for individual factors and the second part to address contextual factors such as the use of ICT and welfare technology. In application of the survey, we expect will shed light on the extent that contextual factors affect the individual factors and the overall assessment by the elderly participants. We have suggested that the survey instrument is administered through interviews and should be grounded in the setting with each patient and with other stakeholders. The next step will include the need to develop three basic versions of questionnaires to be tailored to each of the primary stakeholder groups that is: patients, relatives and support staff. In administration of pilot interviews, we will hope to gain feedback from the project leaders of the Lister project based on their experience with health service provision on the appropriateness of the questions to each target group. Specifically, we aim to pilot the survey
instrument with 1-2 recipients from each of the primary stakeholder groups within 2013.

The goal the survey instrument is to contribute to a better understanding of benefits that assistive technologies can bring to the elderly and of the elderly own assessment of how introduced technologies have impact on their Quality of Life. The design of an appropriate survey instrument to capture this information is an important first step in the evaluation process.

References

Appendix: World Health Organization (WHO) Quality of Life (QoL) Assessment Questions 1996

<table>
<thead>
<tr>
<th>WHO Domain</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>1. How would you rate your quality of life?</td>
</tr>
<tr>
<td>G2</td>
<td>2. How satisfied are you with your health?</td>
</tr>
<tr>
<td>1</td>
<td>3. To what extent do you feel that physical pain prevents you from doing what you need to do?</td>
</tr>
<tr>
<td>1</td>
<td>4. How much do you need any medical treatment to function in your daily life?</td>
</tr>
<tr>
<td>2</td>
<td>5. How much do you enjoy life?</td>
</tr>
<tr>
<td>2</td>
<td>6. To what extent do you feel your life to be meaningful?</td>
</tr>
<tr>
<td>2</td>
<td>7. How well are you able to concentrate?</td>
</tr>
<tr>
<td>4</td>
<td>8. How safe do you feel in your daily life?</td>
</tr>
<tr>
<td>4</td>
<td>9. How healthy is your physical environment?</td>
</tr>
<tr>
<td>1</td>
<td>10. Do you have enough energy for everyday life?</td>
</tr>
<tr>
<td>2</td>
<td>11. Are you able to accept your bodily appearance?</td>
</tr>
<tr>
<td>4</td>
<td>12. Have you enough money to meet your needs?</td>
</tr>
<tr>
<td>4</td>
<td>13. How available to you is the information that you need in your day-to-day life?</td>
</tr>
<tr>
<td>4</td>
<td>14. To what extent do you have the opportunity for leisure activities?</td>
</tr>
<tr>
<td>1</td>
<td>15. How well are you able to get around?</td>
</tr>
<tr>
<td>1</td>
<td>16. How satisfied are you with your sleep?</td>
</tr>
<tr>
<td>1</td>
<td>17. How satisfied are you with your ability to perform your daily living activities?</td>
</tr>
<tr>
<td>2</td>
<td>18. How satisfied are you with your capacity for work?</td>
</tr>
<tr>
<td>2</td>
<td>19. How satisfied are you with yourself?</td>
</tr>
<tr>
<td>3</td>
<td>20. How satisfied are you with your personal relationships?</td>
</tr>
<tr>
<td>3</td>
<td>21. How satisfied are you with your sex life?</td>
</tr>
<tr>
<td>3</td>
<td>22. How satisfied are you with the support you get from your friends?</td>
</tr>
<tr>
<td>4</td>
<td>23. How satisfied are you with the conditions of your living place?</td>
</tr>
<tr>
<td>4</td>
<td>24. How satisfied are you with your access to health services?</td>
</tr>
<tr>
<td>4</td>
<td>25. How satisfied are you with your transport?</td>
</tr>
<tr>
<td>2</td>
<td>26. How often do you have negative feelings such as blue mood, despair, anxiety, depression?</td>
</tr>
</tbody>
</table>

*WHO domains are: 1. Physical Health – pain, discomfort, sleep and rest, dependence on medical aids; mobility; 2. Psychological – thinking, concentration; positive vs. negative feelings, self-esteem; 3. Social Relationships – personal; social inclusion; 4. Environment – financial resources; opportunities for new skills; participation in opportunities. [16]*
“User Participation” and Co-location in software development as evaluating elements in users’ understanding and acceptance of new software tools.

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Abstract. This paper discusses how user participation and co-location, leaning on established work patterns, might impact on developing user-interface abstractions that is immediately comprehensible. This research has followed a project regarding the development of a client/server software for stowing chemical tankers, which is, not only, a complex, but also critical process that must abide by strict international regulations governing the complexity of storing and transporting chemical solubles to and from a multitude of ports. So far, there are signs that extensive and early user participation combined with longitudinal co-location could help define a precise user-interface abstraction level, leading to a positive impact on the user-experience of adopting to new software, which comprises the practical contribution of the paper. Theoretically the paper contributes by situating elements from participatory design in an activity theoretical HCI framework.

Keywords: user participation, co-location, graphical user interface, user-experience

1 Introduction

This paper reports on findings from an ongoing research project, and discusses some theoretical viewpoints of activity theory in relation to human computer-interaction(HCI)-research as it is, as mentioned, part of an ongoing phd-project. In activity theory, human intentions and subsequent actions with the help of tools -mediation, are the most important aspects of the entire activity system.

To comprehend human agency and the contexts and character of which this agency can and do lead to socio-technical activity, have become more and more important in modern software development, also increasing the amount of action and work processes conducted through screen based user interfaces. We see more and more data-, information- and functionality-dense screen properties, which has lead to increasingly complex user interfaces [1-4]. Thus the focus on user-centered system
development based on actual human action on real artefacts, has become increasingly significant.

Research work within the HCI field in general, and the development of the graphical user interface (GUI) specifically, and its historical significance in the socio-technical field plays an important part on the subject of bringing technology to its users [2, 4-12] This is an important perspective in all technological development. Leaning on such a diverse group of theoreticians and practitioners like Engelbart, Kay, Raskin, Carroll, Nielsen, Norman, Shneiderman, Garrett, Tidwell and Löwgren [2, 4, 7, 8, 12-17] to name but a few, we might conclude that the development of web-interfaces and its subsequent simplicity have led more people to use computers in hitherto unknown patterns and in unfamiliar contexts than ever before. The ubiquitousness of computer technology in societal life is mirrored in the business sector, but the alleged importance of self-explanatory design patterns we find in systems open to all, like IE. the web, is not evident in the same manner in large business systems. Although user acceptance is crucial in the web realm, where users can just leave if their user experience is sub-optimal, it should not be a less important element when it comes to large systems within an organisation operated by employees. Perhaps they can't leave when frustrated, as web users can - and do, but a recurring sub-optimal task flow must necessarily lead to a corresponding negative impact on the user experience and subsequent daily productivity in a significant period of time.

1.1 Research objective

The research objective is to determine whether it is possible or even desirable to transfer some of the usability thinking that revolves around self-explanatory and intuitive interfaces, that has been done for years within the web development community, to large and dedicated information systems in the form of customer relationship management systems (CRMs) and enterprise resource planning systems (ERPs).

Our research question is: What kind of impact could user participation and co-location have in developing intuitive user-interfaces with corresponding medial affordances in determining a precise user-interface abstraction level with the subsequent immediate understanding of the user-interface in software development?

The remainder of this paper is set out as follows: chapter 2 provides a brief literature review, identifying some relevant elements of activity theoretical HCI. Chapter 3 outlines the research design approach, while chapter 4 presents the case. Chapter 5 outlines empirical material and discussion, followed by some concluding remarks in chapter 6.

2 Brief review – theoretical approach

In our view, the junction where technology meets human agency is a most significant issue within the IS field, and also the most interesting field to study. Technology in itself could be slightly boring. It is in the space when technology empowers humans,
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help us connect, communicate and collaborate, I find the most interesting sides of technological development. One important, and supporting, perspective of this interaction is the human-computer interaction discourse including usability theory and interaction design [4, 5, 10-12, 15]. Activity theory describes and aims at making this unity of consciousness and activity comprehensible.

2.1 Activity theory

I employ the theoretical approach of activity theory as the foundation for the analysis of my empirical work. The case that I am following is the development and implementation of a software for stowing chemical tankers, ORCA, which is a task of great complexity, managed through computer mediation and abstracted representations in a graphical user interface.

Nardi states that activity theory "focuses on practice, which obviates the need to distinguish 'applied' from 'pure' science—understanding everyday practice in the real world is the very objective of scientific practice. […] The object of activity theory is to understand the unity of consciousness and activity.” Also activity takes place within a context of the group and the group’s goal[18].

Kuuti, Engeström and also Miettinen shows that activity is primarily goal-directed, and mediated by artefacts in addition to being contextual and social. On an individual level the relationship between subject and object is mediated through tools [19, 20]. In an HCI context where the concept of activity is one of the most fundamental ones, activity theory is particularly employable as it “seeks to understand the unity of consciousness and activity.” Therefore activity theory will serve as the foundational theoretical framework for this research project.

I concur with Engeström [21] who states that the unit of analysis when studying human mediated activity, is the community of actors/subjects who shares the goal of the activity, and also Kaptelinin et al. who argues that activity theory in itself is “built upon the concept of mediation”, which makes it particularly suitable for HCI “exploration” [22]. It might be rather self evident to say that because of this, activity theory is especially suitable as an analytical tool, since the case of study is an information system and they are by definition always mediated. But then again, everything is mediated these days, and this argument would render all analytical frameworks where mediation and remediation were included, rather useless.

My perspective on this is that the character of abstraction through mediation should provide for an immediate understanding of the possible features of activity. Also mediation might determine or even predict how, for instance, plans become situated actions, and possibly drift from original intentions [23]. Activity-theoretical HCI, mainly conceptualized by Bødker[24], Kuuti[25], Bannon[26], Grudin[27], Kaptelinin[28] and Nardi[18], distances itself from the traditional cognitive science perspective on HCI, and instead focuses on analysis (and design) in a specific work/activity practice in a multi-user setting, which also includes user participation in the development process and addresses actual use as a part of the design and development phase, in addition to seeing the importance of an interface artefact as a mediator for human action.
In the case presented here, I study the activity of designing a control system, a client/server software, for securely stowing hazardous chemicals for sea transport.

3 General approach / research design

The research is characterized by a mixed methods approach. The software studied is part of a substantial infrastructure that, to a large extent is influenced by a heterogenous array of decisions on a higher, more abstract level. This opens up for a broad set of methods, including interviews with developers and users, observation of users working, maintaining their daily operations, in addition to surveys based on quantitative methods. This combination of qualitative and quantitative methods would hopefully reveal trends in a broad perspective while interviews could reveal underlying in-depth information.

Data collection has so far been, and will continue to be, of a mainly qualitative nature [29]. It will consist of semi-structured interviews with stakeholders, developers, project management, participant users and regular users. Also, field observations of regular users during testing period and after implementation has been and will continue to be undertaken, recognizing the fact that different perspectives including users of varying experience and competence, technical artefacts and corresponding user perception and acceptance are needed in order to adequately cover the research area.

Field observations have been targeted towards developer teams, SCRUM sessions, communication between developers and project management, communication between developers and participant and regular users, as well as observations of user-experiences in the user-system interaction.

Semi-structured interviews have lasted for of period of 45 min-1.5 hours. A digital recorder has been used. Targeted observation sessions of regular users lasted for appr. 2-3 hours, and involved observing the employee’s work tasks. Untargeted observations, have been continuous while the researcher has been present in the field.

Data has also been gathered through surveys directed towards personnel on board and on land, mainly centered around user-experience encompassing system and process support for regular work tasks and user perception of user-interface. The findings are presented in ch. 5

4 Empirical material

This project follows the activity of designing a control system, a client/server software, for securely stowing hazardous chemicals for sea transport. The development process started in January 2012 and will be concluded by the end of January 2013, when the implementation period starts. The case of Odfjell Tankers’ new stowage planning tool is chosen because it is possible to follow the development of the new system during development, following SCRUM teams, project management, and participant and regular users during a longitudinal development
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period. This makes it possible to follow a software project that so closely concurs with the thesis’ research motivation.

4.1 The company

Odfjell Tankers is headquartered in Bergen and is represented through overseas offices in 16 countries. The company is regarded, in its field, as a world leading shipping company, and is among the biggest entities in the field of transportation and storing chemicals and bulk liquids. The company owns and operates a large fleet of chemical tankers, both globally and regionally. Odfjell Tankers also cooperates eleven terminals in South America and one in Canada through associated companies.

The company’s major trade streams cover the United States, Europe, Asia, India, the Middle East and South America.

Summing up, the company’s main business thus includes transporting and storing organic and inorganic bulk liquid chemicals, acids, animal fats, edible oils, drinkable alcohols and clean petroleum products, and the company also operates four modern distillation columns. Some of the cargoes represent hazards as they may be flammable, toxic or corrosive. Examples of cargo would be: alcohols, aromatics (benzene, toluene, xylene), Hydrocarbon solvents, Naphtha, Gasoline components, Gasoil and fuel oil components, Petroleum distillates, and so on. (Odfjell Annual Report 2012)

The fleet of approximately 100 chemical tankers; owned, time chartered, commercially managed, and additionally managed on a pool basis, ranges in carrying capacities from 4,000 to almost 50,000 DWT, and of a variety of tank configuration and coating. Most of the ships are equipped with stainless steel tanks, while some have zinc or epoxy coated cargo tanks. The total capacity of the current fleet is around 2.75 million DWT, and transports 18.5 million tons of cargo to and from almost 500 different ports worldwide, with almost 5000 port calls. The process of loading and discharging more than 600 different types of products can be extremely complex. (Odfjell Quarterly march 2012)

The operators on land are very much involved in various tasks related to vessel performance, including stowage, coordination of port calls, trans-shipments, bunkering and bunkering purchases, supervision of tank cleaning, performance monitoring, weather routing, freight and demurrage collection, and supervising the adherence to rules and regulations related to cargo and cargo handling.

Table 1. The six elements or roles active in the process of stowing a chemical tanker.

<table>
<thead>
<tr>
<th>Ship Operator</th>
<th>Primary user of stowage tool ashore</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vessel, shipboard</td>
<td>Primary user of stowage tool onboard</td>
</tr>
<tr>
<td>Ship Management-internal</td>
<td>Responsible for vessels, crew, ICT systems installed onboard</td>
</tr>
<tr>
<td>Ship Management-external</td>
<td>Responsible for T/C vessels, crew, ICT systems installed onboard</td>
</tr>
<tr>
<td>ICT operations</td>
<td>Responsible for operations and support of ICT tools used within the company</td>
</tr>
<tr>
<td>OT Shipping project</td>
<td>Responsible for new OT application portfolio, incl. onboard solution</td>
</tr>
</tbody>
</table>
The main responsibility the safe stowage of the ship lies within the role of The Master, the highest ranking officer at the shipboard, normally the captain of the ship. In the «Odfjell Tankers Requirements and Guidelines Manual» it is stated that:

«When new cargoes are added to the Cargo / Voyage Order, and new stowage or changes in stowage are required, the Master shall send an updated stowage plan to the Ship Operator.

The Ship Operator may comment on the Master’s stowage, or himself suggest stowage (many Ship Operators are former Chief Officers or Masters), but it remains the Master’s responsibility to safely and efficiently stow the ship.

If more cargo is available for a voyage than the ship can carry, the Master shall seek advice from the Ship Operator to optimize the cargo intake and the voyage result. The Ship Operator may take commercial considerations unavailable for the Master into such planning.»

4.2 The software

From the company’s annual report from 2011 I am informed that «Fleet composition, fleet scheduling and optimal vessel utilisation are thus critical success factors. Flexibility and interchangeability of ships between geographical areas and trade lanes are an integral part of Odfjell’s business model, and are facilitated by our large and diversified fleet.» (Odfjell Tankers Annual Report 2011)

The company decided in early 2011 to develop a new ICT platform in order to provide one common software solution to support Odfjell’s commercial shipping activities onshore as well as on board the vessels. The new stowage software, named ORCA, that makes up this case, will be a part of that platform.

During the last eleven years they have based their daily stowage operations on one specific application, Othello, that, even although sophisticated, contained features that were rarely used, and in principle just made it more complex and slow to work with. In addition, it was intended for both vessels and operators on land, but was never implemented on ships, which in turn added even more to the logistical complexity of managing the stowage processes, as they had to run various stowage simulator systems on board, thus needing parallel systems, not directly communicating with each other, in order to complete regular stowage processes. This has meant that the Othello software has not been utilized as intended.

The new stowage tool should support a new workflow, allowing the operator on land and the shipboard officer to work on the same stowage plan with the same software. This software has been under development from late 2011. From the very beginning, the company vision has been to facilitate for a high degree user-centeredness.

The Vision Scope document developed for the project, and describing the requirements and features of the future stowage software says that the new software, apart from assisting the personnel in obtaining the highest possible vessel utilization, and ensure high quality stowage, it shall be flexible and user-friendly and adapt to organisational changes. Also the system shall enhance proper communication and contribute to better collaboration in regards to stowage related issues. It shall be
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flexible in regards to both existing and upcoming limitations and opportunities that will influence the stowage of vessels, and finally assist users in developing skills and knowledge of stowing chemical tankers. (Alvær, L. G., 2011 ORCA Vision Scope document, unpublished)

Functional requirement of the system includes:

- Importing information from IMOS voyage plans, including:
  - Voyage itinerary
  - Cargo information (Volumes, options, etc.)
- Making stowage plans, including alternatives
- Checking stowage restrictions and the possibility to overrule violated restrictions
- Trim, list and draft calculations
- Generating suggestions for tank selection for cargoes
- Transfer of stowage plans between office and vessel
- Stowage tool to be available on both Odfjell owned and T/C vessels
- Maintaining all basic data to be able to operate independently from other systems


4.3 Stowage workflow

Rotations, with calls and cargoes, are imported or updated in Orca by the operator. The operator then publishes the updated plan. This publication will make the plan available for online users with access to the vessel, in addition to the users on the vessel, which will receive it by email. After stowing the cargoes, the vessel will send the plan back to the operator.

Fig. 1. Stowage workflow.

Step 1: The Operator synchronizes the stowage plan. This will import new rotations, with calls and cargoes, and update the existing ones.
Step 2: The Operator verifies the data in the stowage plan and adjusts it if required.
Step 3: The Operator publishes the stowage plan.
Step 4: The Captain receives the published stowage plan and stows the cargoes.
Step 5: The Captain promotes (or publishes) the stowage plan.
Back to Step 1.
4.4 Software elements

The STOWAGE PLAN is the name of the file managed by the new Stowage System. A stowage plan contains the following information:

- A list of calls, with voyage information (also called Rotations).
- A list of operations (mainly cargo operations), happening in the calls from the Rotations.
- A tank plan and the links between operations and tanks in the tank plan.
- Additional ship information used to calculate ship utilization and trim/list, or to run the COF checks.

The ROTATIONS is a sorted list of calls.

Two levels of calls are managed in Orca: Port (level 1, top level) and Berth (level 2, under a Port).

Each port can be assigned to a voyage.

OPERATIONS: An operation in Orca can be:

- A cargo operation (loading, unloading, transferring or in transit). Transit operations are used to represent cargo operations without other activity in a call. Transit operations are only displayed on the port level.
- A non-cargo operation (port activity or blocked tank).

The TANK PLAN in Orca represents all the cargo tanks and their contents based on the selected calls.

The size and position of the tanks on the screen are only indicative and some difference with the real tank plan can be expected. However, the information displayed in the tank plan (maximum volume and name for example) should be accurate.

VIOLATIONS are generated by the application when an incorrect situation has been detected.

Violations are classified into 2 main categories:

- Soft rule violations. These are warnings for the Operator or the Captain, often requiring verification, but not preventing the stowage.
- Hard rule violations. There are either errors in the stowage plan, or incompatibilities that needs to be removed to have a valid stowage plan.

(from the ORCA user guide, 2012)

5 Discussion

5.1 Co-location of the development team

The development team wanted, as did Odfjell Tankers, a certain proximity between developers and the field of practice which they should serve. Therefore the developers chose to co-locate. They have been placed in one large room right next door to the operation room, where all the future users are present. Thus, the only thing that
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Separates the developers from the users is a single door. One of the reasons for this organization is the presumed low threshold for exchanging information between users and developers, as the developers are seen everyday, from getting coffee from the same coffee machine to having lunch in the same cantina.

Another reason was that also a degree of informal information exchange could take place, as the superusers were present in the proximity and could continuous check the iterations for errors and give immediate, face-to-face feedback. This is important since there is a vast body of experience and competence continuously accessible for the developers, giving the project an agile approach. The co-location arrangement has been continuous for the whole development period.

The initial underlying vision for this software development project concurs with this research project’s research goals: that systems should possess or be endowed with a certain degree of immediacy for new and regular users, while facilitating for work-task efficiency and flow for the skilled users that are going to operate it on a daily, regular basis.

To convey some basic concepts of activity theory and linkage to HCI. I’ll present the empirical material in the case that so far has been gathered.

This case, regards the development and implementation of the client/server software, ORCA, for the control of stowing chemical tankers. A chemical tanker differs from an oil tanker in almost all aspects of being a tanker. An oil tanker transports one type of cargo, crude oil, in five or six huge tanks, from the point of extraction to a refinery. A chemical tanker is significantly smaller, and transports chemicals in a multitude of smaller, specialized tanks, between various port terminals, in a multi-point to multi-point pattern. Also, a chemical tanker must adhere to international rules and regulations that requires chemical tankers to follow the International Bulk Chemical Code (IBC Code) regarding transport of hazardous liquids at sea like i.e. SOLAS ch. VII2 and MARPOL Annex II3. Examples could be that one must, for instance, transport phosphoric acid in a stainless steel tank and not in a tank with coating. Likewise, there are rules for the filling of adjacent tanks - which chemical liquid that may be transport alongside each other. This is an operational practice associated with a significant degree of complexity, sometimes critical complexity.

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2. International Convention for the Safety of Life at Sea (SOLAS). Chapter VII - Carriage of dangerous goods
Fig. 2. Tank plan in the ORCA system.

Mediation. Abducted representation of vessel, with direct manipulation and interaction directly unto the tank representations which provide direct system feedback. The Operation list beneath the tank plan has direct drag and drop functionality, both related to the Rotation list to the left and to the tank plan above. With its activity oriented approach, this follows activity theoretical HCI development.

Fig. 3. Details of tank plan in the ORCA system.

Mediation: Observe how the system provides direct feedback on each abstracted element: recipient port, weight, grade of filling, warning border for adjacent hazard, and so on. It supports drag and drop functionality that facilitates direct interaction in the GUI, thus maintaining support for an unhindered, established work flow.
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Fig. 4 Cargo Operation editor. Mediates detailed editing of Tank plan, such as, contract status, weight, temperatures in tank and adjacent tanks and so on.

There is an adamant need for software that can handle this kind of complexity in a fashion that is as self-explanatory as possible, due to the context and environment that it will be operating. The software will be used both on land, in the company HQ (operations), and on the bridge on all ships loading and unloading cargo (fleet). This means that there will be a rather heterogeneous group of users, as well.

The new stowage software utilizes abstractions in the user interface that, in short, are based entirely on previous practice. User participants have been involved from the very beginning, drawing on experience from a very specific work practice and environment, and also with an established division of work tasks, in addition to ten years experience with the previous software.

This resulted in a set of specifications that relied solely on former practice - intention and action. On top of the user requirements list was «Good user experience/friendliness». The next important points on the list of requirements were:

- Support ease of communication between Vessel- Operator
- Support ease of communication between Operator- Broker
- Emphasis on an intuitive Graphical User Interface (GUI)

This activity based approach, although the term «ease of communication» differs significantly from previous HCI-research, that mainly relied upon cognitive science. Leaning on the depiction of activity as a hierarchically system by Bertelsen and Bødtker[30], and applying this to the intended use of ORCA:
In figure 5, the object (tank) is present only through the mediating artefact (GUI). The tank can only be accessed (loaded or unloaded) through the artefact. The object exists as an actual object (as physical tanks on vessel) but is only available in the use-activity as a representation in the user interface. The object is physically co-present outside the artefact (tank on vessel represented by mediating GUI). Any interaction with the artefact (GUI) will have consequences (loading and unloading of tank) to be inspected on the physical object (tank). [30]

As Kaptelinin argues [22], human agency through mediation is an important aspect of activity theory, and therefore, it provides us with the conceptual tools in order to analyze how people relate to [new] software, and also how, through adherence to ‘rules’ and participating in the ‘community’, a ‘subject’s’ knowledge becomes extended. Mediation in an activity-theoretical HCI perspective is goal- and artefact-oriented4 and therefore quite suitable as an analytical framework for a study of this character.

The results presented here are the answers from the very first survey conducted early in the year 2013, when the software had just been released. A small group of captains and ship officers were surveyed after a one day workshop in how to operate the software. Two of them had been involved as user participants in the development process. Likewise, a group of operators in HQ office, were also surveyed after having tested or used the software in real stowage procedures in a time period from mid January to early March 2013. The survey consisted mainly of a mix of Likert scales and semantic differences, and the results were plotted in radar diagrams.

The findings in the, ongoing, survey so far should indicate that the group of users presently using the software are, to a rather great extent, quite satisfied with the new system. The trends in the empirical material in the survey shows that they are most happy with, or are able to relate most positively to, the elements in the software directly connected to the workflow or their work related experience, as shown in figure 1. This could possibly mean that immediacy based on field discourse and workflow, that is, experiential knowledge, is relatively well maintained. It could also mean that they are simply more comfortable when answering questions in what they regard as their vocational habitat, and correspondingly uneasy when they have to answer questions they regard as “computer science”, in which the majority, according to the survey, is less familiar with.

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4 Previous activity theory literature describes this as object-oriented, but this might be misunderstood as it has other connotations in the computer science/informatics discourse.
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The radar diagrams show the main trends in user satisfaction on scale from 1 (most positive) to 5 (least positive). The diagram in figure 1a shows answers directly related to the field discourse, while the diagram in 1b shows answers to questions about user-interface. The purple field going from the centre and upwards to «1» would indicate the optimal placement for the lines representing user feedback on single questions in the diagram.

As we can see from the diagrams, the users show slightly more satisfaction when they are «on safe grounds», when the questions relate to actual stowage lingua, than when they have to answer questions about user-interfaces, that relates to the computer tool itself. Another aspect regarding the difference in perceived satisfaction could be that while the answers related directly to the field of stowing chemical tankers (1a) were asked using a likert scale matrix, the answers to the questions about how the actual user-interface was perceived, had to be placed on a semantic difference scale matrix, where the survey participant had to rate the different GUI elements of software functionality in relation to opposite word pairs.

The software is not yet installed and implemented on all ships, thus the stowage plans for these ships must be converted or «translated» between two systems leading to a certain intermediate state of parallel work, that should not be representative when the implementation period is over. It was, however important to start surveying and observing participants as early as possible, in order to understand their way of relating to a completely new system, and grasp the «freshness» and «immediacy» of this process.

When observing the survey participants maintaining their regular workflow at their own workstations, the picture changes slightly. When not just talking about how they perceive the new system and its user-interface, but rather show how they handle regular workflow, it might seem like the user perceives more workflow stops when
using the software than is revealed in the survey. The difference is moderate, though, and not alarming.

These brief stops are mainly caused by some back and forth exploration in the user interface when working with the program in addition to slightly confusing tank plans, and could be the consequence of regular beginners issues. Some instances of absent system feedback are detected, though. One of the operators says that they have not been heard when they have reported on what they regard as sub-optimal functionality, like i.e. having to delete information artefacts that are represented with several instances in the system instance by instance, instead of batch deleting.

At one observation session, the main superuser, an experienced former ship officer and operator, checking for user-experience information among the other users, receives user feedback leading him to realize the need for follow-up courses. This could possibly impact on the user-experience analysis.

6 Concluding remarks

The results from the survey, so far, show a rather good user experience. It seems that the planned user-friendliness with which the users were meant to operate the software has, at least partially, been fulfilled. I think this might come from user participation and co-location, giving the developers opportunities to capture needs and the sense of work experience that they would have had access to otherwise.

The pattern in the empirical material shows that users tend to be more positive in their rating of software experience when answering questions that are directly related to the field practice and the users’ experience, than when they are expected to answer questions about GUI, which belongs to the field of «computer science». As the research is still ongoing, it is a bit early to conclude whether this difference stems from the feeling of being secure within their field of experience while feeling not that secure rating software elements in a more HCI oriented approach. This might show that an immediate understanding of user-interface abstractions is closely linked to an experience-based intuition. In this paper I have shown contributes theoretically by situating elements from participatory design in an activity theoretical HCI framework.

Even though premature at this stage, it could also seem that the actual observed user-experience shows slightly less positive than what is reported through the survey, making it hard to draw an unambiguous conclusion at this point.

References

“User Participation” and Co-location in software development as evaluating elements in users’ understanding and acceptance of new software tools.
A Social Relations Perspective on Organizational Business Continuity

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Abstract. Organizations' Information Systems (IS) are subject to various IS incidents. Organizations' efforts for preparing for, mitigating impact of and recovering from incidents, including those caused by IS incidents, are commonly called as business continuity. Scholars interested in business continuity have introduced approaches that through technologies, planning and changes in social behavior enable smooth IS operations. Increasingly, the importance of social behavior for business continuity has been recognized. In this conceptual article, the relation between social relations and business continuity is theoretically analyzed. The theoretical conclusion from this conceptual article is that business continuity is essentially embedded in networks of ongoing and interconnected social relationships that constrain and enable behavior. Discussion of the implications of the conceptual findings are discussed. Suggestions for future research are given.

Keywords: business continuity, embeddedness, social relations, incident, information systems

1 Introduction

Any organization dependent on their Information Systems requires Business Continuity Management (BCM) [17]. Business process streamlining has ensured IS have become deeply integrated to business [37]. The role of IS for organizations has truly and permanently shifted; IS is not only mediating, but enabling operations [21]. Therefore, any IS incident can have significant business impact or even perish an organizations. Organizations need to be prepared for IS incidents. Organizations' efforts for preparing for and responding to incidents, including IS incidents, are commonly referred to as business continuity management (BCM).

Despite that IS scholars have introduced a number of technologies for business continuity [3], and plethora of planning methodologies (e.g., [24]) in the end 'it is people who actually deal with business continuity and crisis' [41, p.28]. It is thus not surprising that the part that social has for business continuity has received increasing attention (cf. [10; 19; 35]).

Technological improvements for business continuity pay scant attention to scenarios when the technology fails, although increased technological complexity
increases the possibilities for the systems to fail. It is as Gall [13] has rather cynically stated 'when a fail-safe system fails, it fails by failing to fail safe' (p. 78). However, in order to understand incidents and failures in socio-technical systems, such as IS [5], the incidents cannot be explained in terms of technology alone [11].

On the other hand, approaches focusing on planning create plans that should govern organizations' efforts to quickly recover from incidents. Instead of proactively preparing, planning focuses on the anticipation of unexpected events [10]. Bounded by the limits of ingenuity, the planners are expected to come up with plans comprehensive enough to guide through incidents of all sort [42]. Scholars have questioned whether it is feasible that 'likely future scenarios can be probabilistically anticipated and that individuals can understand, or at least imagine, their potential impact' [10, p.218]. In addition to technology and planning, business continuity scholars have lately introduced approach coined business continuity management (BCM) that instead of planning or technological solutions emphasizes embeddedness. Practitioners agree on the importance of embeddedness. International and national standards, such as BS-25999 [8] and ISO-22301 [20], share the scholarly view that the purpose of BCM is to achieve embeddedness. Achieving embeddedness is a process realized over time as participation in the business continuity permeates an organization [19]. Central to embeddedness of BCM is to embed business continuity as part of organizational actors everyday work routines and practices, in order to facilitate organizational adaptability and flexibility (Ibid.) to cope with incidents as they arise.

However, past studies on the social aspects of business continuity are scarce. Past research has underlined the importance of culture and organizational values for business continuity [2; 38]. Further, Butler and Gray [10] and Braun and Martz [7] have argued for the importance of proper collective (situated) cognition as a to improve business continuity. In this article, instead of focusing on organizational structures or on cognition the aim of this article is to provide a theoretical analysis on how social relations relate to business continuity. The theoretical analysis suggest social relations, or embedded ties more specifically, provide an interesting and compelling theoretical insight to explain differences in organizational business continuity. Drawing on insights of Granovetter [15; 16] and Uzzi [44], the theoretical conclusion from this conceptual article is that business continuity is essentially embedded in networks of ongoing and interconnected social relationships that constrain and enable behavior.

In order to develop the theoretical insight, first I will shortly review the literature on business continuity management, after which a short introduction to sociological conception of embeddedness is given. Thirdly, I will integrate the sociological insights with prior literature on BCM in order to increase understanding on organization's preparations and response to IS incidents. Lastly, discussion on the conceptual findings are provided and conclusion drawn.
2 Business Continuity Management

Business Continuity Management (BCM) is a holistic management process [18] that aims to prepare organizations for incidents of any type. Although BCM aims to cover all sources of incidents, central to contemporary organizations is the well-being of its critical IS [37]. Without appropriate organizational measures IS incidents can cause significant damage to or even perish an organization. The concept of BCM originates from practitioners [47], but has found its way to multidisciplinary scholarly discussions. IS scholars have applied the ideas derived from the multidisciplinary business continuity literature in IS security [6; 25] in IS operations [10] and in information strategy [14] to name a few.

As a management process, the BCM aims to shift perspective from planning to managing. Planning approaches have been criticized to focus only on creation of plans, that is likely to end up as unwanted bureaucracy [41] failing to provide any real value for the organization. To level some of this criticism, business continuity scholars have emphasized the importance of organizational commitment and employee involvement to business continuity practices, a substance of BCM coined as embeddedness [19]. Organizational commitment and involvement should ensure the employees are aware and understand the importance of business continuity [25; 26]. Thus, it is likely that any BCM endeavor will have to deal with user resistance, opportunistic behavior, and induce changes to existing social structures. To mitigate some of these adversities and to ensure proper allocation of resources, prior literature on BCM has underlined the significance of top management support (cf. [24]; [6]).

BCM also incorporates stages of planning. During planning, organizations prepare plans that define measures for responding to IS incidents and describe steps that govern employees’ actions during recovery. The planning is a joint task where input and involvement is required from heterogeneous organizational members, and requires information exchange among employees to be successful [45]. As part of planning, organizations need to prioritize their systems, which requires input from the top management. The IS systems need to be prepared for possible IS incidents and procedures for recovery actions should be put in place [14]. The accuracy of the plans should be verified through periodic or change initiated reviews [14]. To increase assurance on the implemented BCM, audits can be used [12]. In addition, a leader for the endeavor, who should coordinate the overall business continuity efforts and ensure all measures are in place, should be appointed; a task that is often appointed to IS managers [30]. Coordination skills, such as the ability to lead a BCM committee, have been found as the most significant personal skills for BCM leader [40]. All multifaceted and diverse BCM responsibilities that span across departmental borders [2] should be clearly and explicitly defined [12]. Distributed responsibility requires shared information and depends on shared skills [46].

One of the ongoing conflicts in the literature is the role of plans versus social response to incidents. Stucke et al. [42] argue organizations response to incidents should be based on well-tested plans and not on adaptability, whereas those emphasizing the social response, have questioned whether predicting all possible future scenarios is feasible [10] and noted that ‘[a] blinkered faith in planning, and using the past as a mirror to the future, is likely to lose the initiative by constraining the understanding, insight and lateral thinking by of quality employees’ [46, p.379].
Indeed, managing behavior contra prescribing it in plans is a difficult balance to achieve, especially under adverse circumstances [19] that are characterized by uncertain responses and uncertain outcomes as well as tight time constraints.

Embeddness is assumed to improve organizations’ ability to detect emerging incidents as well as to cope with them. Dealing with incident requires adaptability and flexibility [19] in which BCM can play a decisive role [29]. Butler and Gray [10] have argued for the significance of collective mindfulness for business continuity. Collective mindfulness emphasizes the importance of properly situated collective cognition. In other words, organizational members are to consciously evaluate and come up with novel solutions to a problem at hand. As Butler and Gray argue, mindfulness is not about choosing the best option amongst available options but to come up with new (novel) options [10]. Therefore, while the planning techniques and routines may impact organizations’ ability to perform reliably, the impact of the planning techniques and routines is affected by the degree of which they either enhance or are enhanced by collective mindfulness (Ibid.).

In addition, Alonaizan [2] and Sawalha and Anchor [38] suggest a shift in organizational culture is required and Freestone and Lee [12] and Tammineedi [43] see that business continuity should be adopted as organizational core value. The organizational social structures (e.g., culture and values), are assumed to ensure correct collective actions for preparing for and responding to an incident. Through awareness, training, education [41], and exercises and maintenance [2] a business continuity culture is expected to result. As awareness refers to employees knowledge on a given topic [9] the purpose of the practices is thus to increase employees knowledge on business continuity, in order for the employees to fully internalize the organizational business continuity message [2]. Morwood [25] argues the contents of awareness and training should be tailored in such a way that the lessons can be arranged in most convincing manner to a specific target group to ensure success. Thus, BCM culture seems to emerge as an aggregate of individuals knowledge.

Despite that social relations have been found to influence organizational and individual adaptability, cooperation and response during incidents and organizational crisis [22; 35], past literature on business continuity has not paid any attention to the social relations. Business continuity as a context of study however has potential to illustrate new aspects of social relations.

3 Sociological Conception of Embeddedness

In order to fill some of the gap identified in the previous chapter, a sociological conception of embeddedness is first introduced in general and then a framework for embeddedness from Uzzi [44] is discussed. As noted by [31], the same ideas represented in embeddedness have been present all along in sociological tradition. It is not for its originality, or uniqueness of this theoretical perspective, but due to the way how it encapsulates this tradition. Further, the concept of embeddedness offers insights into the quality of social relations, rather than the structural configurations that characterize the interconnected network of social relations [39].
3.1 Background

The concept of embeddedness has become to explain economic behavior, although Granovetter's conception of embeddedness is also suitable to explain wider social action:

'Actors do not behave or decide as atoms outside a social context, nor do they adhere slavishly to a script written for them by the particular intersection of social categories that they happen to occupy. Their attempts at purposive action are instead embedded in concrete, ongoing systems of social relations' [15, p.487].

The citation above not only indicates the wide applicability of Granovetter's conception of embeddedness, but also neatly positions Granovetter's conception of social action in relation to the canonical conceptions of social action. The canonical conceptions of social action, according to Granovetter, were either under-social or over-social. Figure 1 illustrates the positioning of embeddedness in relation to other schools of thought. It is important to note that the purpose of the illustration is only to convey the positioning in regards to how the schools of thought have viewed social action.

![Diagram of social action conceptions](image)

**Fig. 1** Positioning the embeddedness (based on Granovetter (1985))

In Granovetter's thought the under- and over-social views differ in how they view social action: '[i]n the undersocialized account, atomization results from narrow utilitarian pursuit of self-interest; in the oversocialized one, from the fact that behavioral patterns have been internalized and ongoing social relations thus have only peripheral effects on behavior' [15, p.485]. In other words, what both of these share is atomism[23]. In over-social view individuals adhere slavishly to norms and values they have thoroughly internalized and thus knowledge of social structures becomes irrelevant (Ibid.). In under-social view the social outcomes follows from aggregation of actions taken by rational individuals in isolation from others (Ibid.). Instead, social action is embedded in networks of ongoing social relations [15].

The embeddedness is not a binary, but a continuum. The level of embeddedness affects action [15]. With social relations comes also the sense of social responsibility that decreases the likelihood of malfeasance. However, when the level of embeddedness raises too high, it opens possibilities for malfeasance, that is, opens up possibilities for exploiting the others, perhaps best summarized by the sentence 'you always hurt the one you love'.
3.2 Conceptual framework of embeddedness

Granovetter's conception of embeddedness has been criticized for being too general for application. Uzzi's [44] framework provides the needed applicability. The framework has three components: 1) trust; 2) fine-grained information exchange; and 3) joint problem-solving arrangements. The framework has been successfully utilized in prior IS research, as discussed later.

Trust - In forming embedded ties, trust is the most central as it enables the parties to engage in an activity. Trust is expression of expectations about individual’s future behavior, often based on prior interactions [36] or mediated through common acquaintance [15]. Organizational members are assumed to possess expert knowledge and not willing to divulge information that is strategic or private in nature except for those they trust [34]. In addition, trust enhances cooperation amongst employees. When one trusts another, one expects honorable behavior from another, that is, one trusts that the other will not use information or engage in activities that are harmful. If the trust is broken, cooperation amongst employees will be severely impaired [22].

Fine-grained information exchange - Trust opens the possibility for fine-grained information exchange [44]. Amongst embedded ties, information exchange is more fine-grained than in other relations (Ibid.). The information shared between embedded ties tends to be more tacit and proprietary than in other relations [34]. Without trust, the parties are not willing to engage in fine-grained information exchange, as there is too large of chance for opportunististic behavior or even malfeasance [15]. Individuals can be reluctant to engage in information sharing if they fear criticism from peers or recrimination from management [4].

Joint problem solving arrangements – Joint problem solving does not only mean solving problems together. When embedded ties have been formed, each party can trust others to solve problems as they arise. Uzzi [44] when discussing apparel industry, found that organizations who had embedded ties, seemed to trust others would solve problems proactively for their benefit and to help them avoid catastrophic consequences. For instance, organization producing apparels had found that fabric dyed with a certain color shrunk more than fabric colored with other colors. As such, the organization would cut the fabrics differently in order to ensure the end products would meet the customers’ needs even though this had not been contractually stipulated. Indeed, the customer was not even aware of the need to cut the fabrics differently. The joint problem solving amongst those parties who share embedded ties suggests the organizations were willing to ‘go the extra mile’ as of their social relations. It is as [33] explains, generalized reciprocity involves "not 'I'll do this for you, because you are more powerful than I,' nor even 'I'll do this for you now, if you do that for me now,' but 'I'll do this for you now, knowing that somewhere down the road you'll do something for me’” (p. 182-183) (quotes theirs)

Although the concept of embeddedness originates to denote a form of inter-organizational relation, spanning beyond the confines of a single organization, the social relations within the firm might be more dense and long-lasting on the average than existing between [organizations]” [15, p.495]. As such, it is expected that embedded ties also has significance for an intra-organizational endeavor, such as BCM.
3.2 Embeddedness in IS research

In IS literature, the sociological conception of embeddedness has been used to analyze social networks in organizations as well as outsourcing/offshoring. As an illustration of past contributions, in IS offshoring literature, [34] studied the offshore project success through the theoretical lens of embeddedness. Utilizing a longitudinal field study, analyzing 155 offshore projects, the authors conclude 'offshore IS projects should be managed with a systemic emphasis on relational [social relations] and cultural factors' (p. 633). In addition, [39] analyzed the formation of social relations in practice through a lens building largely on the Granovetter's conception of embeddedness. Their findings suggest, the use of IT in managing customer relations poses challenges to especially organizations that rely on embedded relations.

4 Social Relations in Business Continuity Management

Building on past literature, central for BCM is to: (1) facilitate creation of plans in such a way that accurate and comprehensive plans that are integrated as organizational practices result; (2) deal with governance, i.e., ensure that appropriate, agreed measures (e.g., plans, technologies, processes and procedures) are actually implemented across organization; (3) facilitate conditions for information sharing; (4) facilitate conditions for dealing with cues of possible incidents as they arise; (5) facilitate organizational adaptation to incidents. Next, building Uzzi's [44] framework and theoretical insights of Granovetter, a discussion on the relation between social relations and business continuity is provided to show how the social relations can to a large extent explain the success or failure of organizational business continuity. A summary of how social relations can explain organizational business continuity is provided in Table 1.
Table 1 Summary of the relation between embedded ties and business continuity

<table>
<thead>
<tr>
<th>BCM</th>
<th>Embedded ties to BCM</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) facilitate creation of plans in such a way that accurate and comprehensive plans that are integrated as organizational practices result</td>
<td>Embedded ties facilitate employee commitment to plan creation and sharing of fine-grained information that is needed in order to create plans that are accurate and comprehensive.</td>
</tr>
<tr>
<td>(2) deal with governance, i.e., ensure that appropriate, agreed measures (e.g., plans, technologies, processes and procedures) are actually implemented across organization</td>
<td>Embedded ties facilitate dyadic trust and a sense of social responsibility. Trust and social responsibility facilitate conditions in which employees are more likely to be willing to implement the agreed measures, and even 'go the extra mile' when needed. Further, employees who have a sense of social responsibility are more likely to do a 'favour' to another employee with whom they have embedded ties.</td>
</tr>
<tr>
<td>(3) facilitate conditions for information sharing</td>
<td>Through embedded ties employees are willing to share even information that is more tacit and private in nature. Further, information shared through embedded ties is likely to be more fine-grained than in other relations.</td>
</tr>
<tr>
<td>(4) facilitate conditions for dealing with cues of possible incidents as they arise</td>
<td>Embedded ties are likely to encourage employees to raise perceived cues of IS incidents for discussion and proactively solve issues (i.e., joint-problem solving arrangements) before the issues escalate into large scale incidents.</td>
</tr>
<tr>
<td>(5) facilitate organizational adaptation to incidents</td>
<td>Embedded ties facilitate cooperation that increases organizational adaptation to incidents. Past incidents may create or deepen the embedded ties which further contributes to improved organizational conditions for incident adaptability.</td>
</tr>
</tbody>
</table>

The theoretical relation between social relations and business continuity is illustrated in Figure 2.

![Fig. 2 Conceptual framework](image-url)

Next, a discussion to elaborate the illustrated relations is provided. Trust - Trust should be seen as an integral part of efforts for preparing for and responding to IS incidents. Organization's ability to prepare for and respond to IS incidents requires employee commitment [19], which is not feasible to expect without trust. Trust forms the basis for embedded ties [44].

Trust amongst employees participating in BCM, is expected to form when individuals congregate to form organizational BCM or through transitive embedded ties. For instance, awareness and training sessions have potential to increase trust to BCM leader, if the BCM leader himself is present. In addition, complements and recommendations by already trusted peers can create trust to third party. Such is likely in BCM when the BCM leader is perceived trustworthy by some system owner, who then can recommend the BCM leader to other system owners. It then becomes
instrumental that the BCM leader is actively involved in the BCM, rather than merely
distributing responsibilities, i.e., giving them 'from above', or by appeal to fiat.
The preparation for IS incidents should rely on the input of those specialized and most
knowledgeable on certain organizational function. For instance, those responsible for
IS systems, must prepare suitable and realistic plans for preparing for IS incidents.
The preparation of detailed plans that should govern employees' actions during a
recovery is only feasible to expect from those expert in the specific organizational
function. The experts are likely to be reluctant to expose such tacit, fine-grained
information that is private and strategic [34]. Trust can facilitate sharing of such
information that is not possible in the absence of trust. It facilitates sharing of
information based on an open architecture that promotes sharing of information and
expertise crucial for successful business continuity (will be discussed more
thoroughly below). However, the embedded ties may also be counter-productive for
the preparations. Within a group of individuals who share embedded ties, novel
information is a rarity. Rather, such information is more likely to flow through
relations that are not embedded ties, i.e., from acquaintances [16]. As the threat
landscape evolves and improved planning techniques as well as technologies evolve,
information of such changes is crucial for business continuity. A group that shares
embedded ties may thus become 'blind' for the novel approaches for business
continuity emerging in the extra-group environment.

With embeddedness comes also the sense of social responsibility [15] that is one type
of commitment. Instead of organizations enforcing employees for commitment to
business continuity, the sense of social responsibility is assumed to ensure proper
actions by those whose task it is, as a form of generalized reciprocity. Thus, instead of
hierarchical, management mandated approach, social relations afford a governance
based on reciprocity, in which embedded ties may replace or complement formal
governance structures. However, such view is not without its deficiencies. When the
social relations are overly embedded (characterized by high levels of trust),
possibilities for malfeasance open [15]. For instance, trust may become too high and
prevent healthy suspicion. Within business continuity, as discussed earlier, the
preparation of plans for IS is a task that requires input and actions from the system
owners. When the level of embeddedness rises too high, it might open possibilities for
opportunistic behavior. A person responsible for implementing plans and measures
for mitigation of IS incidents might not do what is expected and on the other hand,
those responsible for leading the BCM endeavor might not question whether the
measures have really been implemented. In order to increase assurance that measures
have been implemented and are sufficient, organizations may use auditing. However,
while auditing of BCM may provide assurance to top management [12], literature on
economics suggests audit practices 'actually creates the very distrust it is meant to
address' [32, p.10].

Trust by enhancing cooperation increases adaptation to incidents [22] and thus
improves organization's response to IS incidents. In addition, a successfully handled
incident is likely to improve the social relations amongst employees. Past (positive)
experiences in general, strengthen social relations, and “surviving” time constrained,
stressful situations is likely to even create friendship.

Fine-grained information exchange - Distributed responsibilities necessitates
integration of information [46] between BCM participants. Individual employees
participating possess specialized knowledge of distinct organizational functions that is required for BCM. The knowledge is likely to not reside solely within IT function, but across number of functions to which the manager may not have jurisdiction, creating a 'conundrum of CIO' [27]. Those who possess knowledge on business operations are dependent on those who possess the knowledge on how the systems are maintained and what are their weaknesses as well as how quickly a system can be recovered in the event of IS incident. Those who possess the knowledge on operating information systems depend on the knowledge of business managers to decide whether their systems are able to recover as quickly as expected. Thus, to be successful, preparing for IS incidents requires exchange of fine-grained information, that is unlikely to occur in absence of embedded ties. Without established social relations, system owners might not be willing to reveal tacit or private information about their system, such as weaknesses in the implementation that might be of crucial importance. System owner might be reluctant to share such information as revealing it might damage the system owners image as being 'sloppy' or criticized in other ways. Further, sharing of such private and strategic information would be difficult, if not even impossible, to stipulate a priori with explicit, written policies or descriptions of responsibilities, as they might be highly sensitive and dependent on a specific system. Joint problem solving arrangements - When planning for IS incidents, the joint problem solving facilitates solving problems “on the fly” [44]. For example, contemporary information systems are complex systems that consist of multiple components. When preparing for disasters, it is important to realize the dependencies of the different components and not only see each part in isolation. Instead of only focusing on a single system, through embedded ties the IS managers may themselves engage in problem solving and account for the system dependencies proactively. Without such joint problem solving the results could be catastrophic in case of incident. The preparation of information system without accounting for all the components it consists could render the system non-operational despite the preparations for one of its components. Enforcing such requirements a priori on systems/system owners can be a task impossible to realize. Within the context of business continuity, when responding to IS incidents, solving problems as they arise is crucial. Instead of waiting for small issues to cascade as large scale disaster, organizations should have sensitivity to perceive cues of emerging disaster and act as they arise [10]. Such actions require not only joint problem solving arrangements, but also trust and fine-grained information exchange. Employees have to have trust in order to address and bring up cues they perceive that could lead to a disaster without the fear of criticism. Reacting to such cues on the other hand requires exchanging information that might be private in nature, for instance information of mistakes made by peers or by self. The significance of joint problem solving becomes even more pervasive when the organization has to respond to IS incident. Although comprehensive plans can go a long way, it is not feasible to expect all possible scenarios could be assumed beforehand. Social relations influence the employees’ response to incidents [35] and adaptability [22]. IS incidents require joint problem solving of multiple individuals, all solving problems at the same time, even if no central orchestration exists. Consider, for example, a simple scenario where a business critical IS has failed. The business units have to solve problem of finding ways to cope with the incidents with
minimal business impact, IS managers ways to recover quickly and in correct manner and PR to solve what information and how much can be given to public. Then, '[t]he trick is to have an organisation with enough internal trust so that it can be left to be self-organising in face of external threats' [46, p.373].

5 Discussion and Conclusions

This conceptual article sought out to understand how social relations relate to business continuity. Building on literature on BCM and on sociological conception of embeddedness, the theoretical arguments suggest understanding how social relations enable and constrain behaviour influences business continuity. Indeed, the social relations may largely explain the differences between organizations' business continuity. The social relations can thus provide insight to understand why some organizations are more successful in their preparations and more responsive to incidents. Consequently, more emphasis should be put to social relations in BCM literature, in order to improve organizational BCM practices. The theoretical conclusion from the theoretical analysis is that business continuity is essentially embedded in ongoing social relations that enable and constrain action. Next, I will compare and contrast the theoretical insights to prior literature. To support the discussion, Figure 3 provides an overview of positioning the study in contrast to prior literature.

Fig. 3 Contrasting embedded ties view to prior BCM literature

If it is truly 'people who actually deal with business continuity and crisis' [41, p.28] then the actions they make are of crucial importance. Prior BCM literature on embeddedness has suggested the BCM should be embedded to organization, whether it is 'everyday practices' [47], work routines [14], culture [2; 38] or core values [12]. These approaches share an over-social view [15] on social action. The approaches aim at making docile bodies that slavishly follow a script embedded in the social structures (e.g., in culture, core values), neglecting individuals capability to make independent choices. The social structures which they happen to occupy, when internalized, works as scripts that others have written for them, determining the course of their actions. The employees are to mindlessly act according to the culture
and be oppressed by the norms and values embodied in it. In other words, when BCM has become a part of culture (or norms etc.), the actions individuals make will be according to that scripted in the culture (or in norms, values or 'everyday practices'). Thus the culture itself is not of interest, but it is a means for reaching a given end.

On the other end of the continuum lies the under-social views that emphasize employees' knowledge. The little what has been said about business continuity awareness and training assume if only the individual is aware of the importance of BCM or if only the individual is knowledgeable enough (e.g., the right course of action has been internalized through exercises) right actions will follow [25]. Such under-social views do not account for the social structures and how they might bind action. Employees are to rationally evaluate options imaginable to them and afforded by their knowledge on how to optimally perform under given circumstances and to choose a proper course of action.

Instead, what have been proposed here, is an understanding of business continuity as embedded in ongoing networks of social relations that enable and constrain behavior. In such a view, the actions are not merely guided by the internalized social structures, neither determined by knowledge, but constrained and enabled by the ongoing interconnected social relations. The intention is not to suggest culture would be irrelevant, or that awareness and training would not have an impact on BCM. However, the extent of which they enhance or are enhanced by embeddedness of BCM is influenced by the extent of embedded ties within an organization. This has practical implications, as the theoretical discussion suggests more emphasis should be placed on fostering embedded ties across organizations.

Analyzing the social action in the context of business continuity has further implications for business continuity literature. The theoretical insights from Granovetter could be used to position the prior views on social action in business continuity literature as discussed above. This paves way for understanding of organizational actions around business continuity that do not overly emphasize the social structure, neither the agency (e.g., the cognition or 'free-will'), but aims for balanced understanding. Further, the theoretical findings brought forward here provide further support that the social relations influence response adverse conditions [35] and widen the understanding to IS incidents.

In considering the social relations, the view taken here is that some employees are more important than others when preparing for and responding to IS incidents. This view reflects the BCM arrangements organizations have in place, as also noted by Butler and Gray [10] and as further suggested by my experience as a consultant. Organizations prepare for and respond to IS incidents by mobilizing expert resources (e.g., IS managers, system owners, system administrators), not as an organizational collective. However, this argument is not fully explanatory. Especially in large scale IS incidents, the incident is an organizational concern to which the whole organization has to respond (as discussed already above). Such understanding of organizational response to IS incidents necessitate the embedded ties (at least to a certain degree) would have to be shared across organization. Would such conception be feasible to achieve, is a question that will have to wait for future empirical research.

Future research should study whether the theoretical analysis presented here also hold in practice. As the embeddedness forms over time, a process analysis [28] of the
shaping of embeddedness and embedded ties would be fruitful. More specifically, the view promoted here suggests the embeddedness of BCM is a continuum in which the business continuity at one end is 'a mere plan' and at another end the business continuity is 'not merely a plan'. Further, in this view the embedded ties are also a continuum from 'no social relations' to 'intimate relations' between those participating in organizational business continuity. The implications of this view on organizational business continuity was merely touched upon in this conceptual article. The complexity, however, provides many interesting paths to be explored that has potential to improve understanding of not only business continuity but also on social relations. In addition, much of the late literature focusing on social relations has seen fit to focus on an 'umbrella term' coined as 'social capital' [1]. Future research should also study how social capital, that incorporates also sociological embeddedness, might improve and complement the view on embeddedness of BCM presented here.

References

Aging in place: Dealing with breakdown of welfare technology
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Abstract. The paper is about breakdown of welfare services that occur within the contextual frame of elderly interacting with welfare technologies. Explicitly it emphasize breakdown as a phenomenon that need to be taken into account when designing welfare technologies involving new practice of cooperative work between elderly and the circumstance they are operating within. The paper focuses on the equipmental breakdown in context, which is recognized as breakdown that occurs in human relationships that are mediated by use of technology. Thus, prior studies have accounted the concept of breakdown primarily to the work done by Heidegger. Heidegger restricts his way of viewing breakdowns into being interruptions of habitual activities of super users, and he has paid little attention of unskilled users or laypersons of equipmental activities. However, elderly and their caretakers are often recognized as laypersons when it comes to interacting with new technology devices and unknown user interfaces. In this matter, it is necessary to understand breakdown situations including unskilled users that are engaged in social relationship by mediation of welfare technology. Therefore it was found constructive to apply the theoretical framework of activity theory, and especially recognize the work of Leont’ev and Engeström in regard to their understanding of human activity. Leont’ev argues that initially are all tool mediated human activity done by unskilled practitioners that need to learn new practice of actions before being able to engage in a human activity as skilled users. Additionally is Engeström’s human activity system model used to identify and understand occurrences of breakdown of welfare services within a minimal contextual frame of elderly users of welfare services. Thus, the paper presents an analysis of three selected breakdown situations based on material gathered from field work. The study displays findings of breakdowns that vary in degree as some breakdowns are unacceptable as they are serious interruptions of welfare services that in worse case scenarios could harm the well-being of elderly, while other breakdowns are of less concern, but still damaging as they may ruin the trust the elderly put on technology for keeping them safe and independent. Furthermore does the study recognizes the importance of a human respondent system of welfare services, which in situations of breakdown step forward and articulate re-distribution of work as a temporary coping mechanism while recovery from breakdown.

Keywords: breakdown, welfare services, activity theory, coping mechanisms, articulation work
1 Introduction

This paper is about breakdown of welfare services that occur within the contextual frame of elderly interacting with welfare technologies. Explicitly it emphasize breakdown as a phenomenon that need to be taken into account when designing welfare technologies involving new practice of cooperative work between elderly and the circumstance they are operating within, as well as it addresses the corresponding coping mechanisms for dealing with breakdown for recovery. Bardram [1 p. 89] states that “understanding the dynamics of cooperative work is extremely important as a way to understand how to design computer systems supporting cooperative work”. There is a need to understand the social – technical dynamics of introducing welfare technology within the private homes of elderly to accomplish the ambition of elderly aging in place¹. The reason being is that innovation of welfare services are delegated great responsibility and trust in HCI as a part of supporting the well-being of elderly. Additionally will such an innovation change current work practice as welfare services prior done by human resources from the welfare service organization now are being re-allocated and delegated to the elderly themselves, by introduction of various technologies. Although, elderly wants to age in place in the meaning of living home and postponing their institutionalization to nursing homes as long as possible, they might find it challenging to deal with technology in several ways such as navigating, interacting, configuring and maintaining various technologies. Though, both elderly and staff within the welfare service organization are likely untrained users of welfare technology, and therefore need to learn new practice of cooperation before becoming experienced and skilled technology users. Hence, welfare services that are delegated to HCI within the context of welfare service organization may suffer in initial implementation as technology has a higher potential of failing to handle the distributed responsibility in the hands of laypersons i.e. people or technology may not always act or respond as planned. Therefore, the phenomenon of breakdown in this relation is more than merely about technical failures; as it as well includes breakdown that occurs cause of social constructed disturbances within the relationships mediated by use of new technology. Nevertheless do the health authorities’ have hairy objectives when introducing welfare technology into the homes of elderly as the authorities aim to increasing their independency, safety, support and encourage elderly in coping with own health issues, improve communication between healthcare services, residents and their families, and by this achieve an improved cost-effective elderly care by already scarce health resources [2].

The paper aims at addressing three research questions:
(1) What types of breakdown occur in the field of welfare services?
(2) What are the coping mechanisms for recovery of these occurrences?
(3) How do breakdowns in welfare services affect the elderly aging in place?

¹ The Center for Diseases control and Prevention defines the term Aging in place as “The ability to live in one’s own home and community safely, independently, and comfortably, regardless of age, income, or ability level” (Ref. http://www.cdc.gov/healthyplaces/terminology.htm)
The paper starts by looking at the concept of breakdown, and focuses on activity theory as a theoretical framework to explore situations of breakdown comprising new practitioners of technology within a contextual frame. The paper builds on field work done at a location including smart homes for elderly where the elderly as a part of a 2-years pilot study are able to test welfare technology introduced to them. The concept of breakdown, occurrences and corresponding coping mechanisms for breakdown recovery are analyzed and discussed.

1.1 Concept of breakdown

The concept of breakdown can be related to several types of breakdowns such as mental breakdown, organic breakdown, social breakdown, communication breakdowns, conceptual forms of breakdowns and equipmental breakdowns with others [4]. This paper focuses on the equipmental breakdown in context, which in this paper is recognized as breakdown that occurs in human relationship that is mediated by use of technology.

The concept of breakdown has most often been accounted to the work of the German philosopher, Martin Heidegger, especially in relation to his book Being and Time [3]. However, Heidegger himself did not use the term breakdown, even though he by many authors has been acknowledged as the originator [4] by his recognition of “the role of breakdown or failure as a means of revealing the nature of the world around us” (3 p. 25). Heidegger describe the phenomenon of “being in the world” [4]. This phenomenon he acknowledged as Dasein that is the German term for existence or being. Heidegger acknowledges breakdown as being a graded phenomenon [3]. To illustrate his viewpoints in this matter, Heidegger uses a known metaphor about the trained carpenter and how his tool, the hammer, including the tool’s properties influences the carpenter’s awareness or consciousness during mediating the hammer for an activity. Koshmann et al [4] refer to Heidegger’s statement “…In ordinary use, resources (tools, implements, appliances) with which we conduct our day – today activities do not usually require (or attract) our conscious awareness. As the carpenter has his hammer “ready in hand” [3 p. 69/98] and the hammer is well-functioning, the carpenter is enable to hammering without no conscious thoughts or awareness about the activity. He by this argues that in ordinary use when an expert user has his tool “ready in hand” can be so “absorbed coping” with his tool to such a degree that the tool has become complete integrated to his habitual activity that it is experienced like an extension of him rather than being an object from the material world. Koshmann et al [4] further emphasize according to Heidegger “that when ongoing, non-reflective practice is interrupted, these equipmental aspects of the world become “lit up” [3 p. 72/102] or brought “into view” [3 p. 74/104]. Hence, Heidegger [3] grades breakdown by describing three other status of entity from “un-ready at hand”, “present at hand” and “purely present at hand”, which degrees the skilled users’ mediation with the tool according to its appropriateness. He by this refers to “un-ready at hand” as being a situation where the carpenter needs his
hammer but the hammer is absent. This means according to Heidegger that if the carpenter finds another hammer that could be appropriate for the intentional activity, then the carpenter can go on with the activity without further considerations. In doing so the nature of the activity is deliberate by the carpenter from the beginning, but could turn out as being absorbed if the alternative hammer is appropriate for the specific activity [3]. However, if the alternative hammer is inappropriate for the activity, the carpenter starts to reflect about how to approach the activity with the tool he has “present at hand”. In this situation, the carpenter would be more aware or conscious while using the equipment. I.e. if the only hammer present has a cracked handle that is taped, the carpenter would reflect upon how much power he uses while hammering to avoid the handle to crack even more or he might have to hold the hammer in an unusual manner that disturb the hammering. In the end, Heidegger describe the status of entity as a “purely present at hand”, which could be interpreted as a complete breakdown situation where the carpenter has a hammer in his hand, but the tool is in such miserable state that it is unusable, and needs recovery.

Beynon-Davies and Holmes [5] claim that Flores and Winograd [6] where one of the first who adapted the concept of breakdown from Heidegger, and introduced the concept within the field of Computer System Design. Flores and Winograd [6] recognize breakdowns by following Heidegger’s understanding of breakdown as being “the interrupted moment of our habitual, standard, comfortable, being in the world”. Additionally, the school of participatory design in Aarhus, especially the work done by Bodker [7] has recognized the concept of breakdown in relation to design as “situations in which unforeseen changes in the material conditions of some human activity causes a reflection on everyday actions which would not normally occur”. Heidegger’s work associated with the concept of breakdown is valued as essential for understanding the nature of breakdown phenomena. However, Heidegger has restricted breakdowns as being interruptions of habitual activities of super users, and he has paid little attention to unskilled users or laypersons of equipmental activities. In this matter, I have to look elsewhere to understand breakdown situations of unskilled users that are engaged in social relationship by mediation of welfare technology.

1.2 Activity theory as a theoretical framework

Koschmann et al [4] has recognized Leont’ev’s Activity theory [9], [10] and his understanding of the human activity as being “units of life, which are organized into three hierarchical layers” [8] as similar to Heidegger and his work of understanding of being in the world [3]. Leont’ev’s three levels comprise from the top; the motivated human activity followed by the layers of goal-oriented actions and conditional operations, see figure 1. Koshermann et al [4] especially emphasize the corresponding mechanism related to the hierarchical levels of activities, and the traverse of levels as being associated with the concept of breakdown. However, in contrast to Heidegger, Leont’ev acknowledges that skilled users need to acquire their knowledge before
achieving the status of being an expert user [10]. Leont’ev argues that initially all tool mediated human activity is done by unskilled practitioners that need to learn new practice of actions before being able to engage in a human activity as skilled users [10]. In the phase of learning, practitioners are planning new activities and their actions are by this goal–oriented conscious actions, see figure 1. First, when these conscious actions are sufficient repeated they become habitual sub-actions and by this traverse layers and turn into routinized operations. Leont’ev further argues that routinized operations can be disturbed and change according to the original plans, which forces the operations to traverse back upon the action level, and again become conscious actions of new practice that need to be learned [10]. The shifting mechanism between conscious actions and unconscious routinized operations therefore make the human activity dynamic as the activity is always developing into new practice by learning. Leont’ev’s understanding of human activity is acknowledged as informative lens when studying human activity of unskilled welfare technology users that need to learn new practice before they advance into skilled users enabled in doing “habitual” interactions with new technology in the sense of transforming an object into an outcome.

Figure 1 - Kaptelinin’s [8] illustration of Leont’ev’s hierarchical structure of activity (Copyright: Kaptelinin 2013)

Therefore Leont’ev’s activity theory is found constructive when exploring situations of breakdown from my gathered field material. Activity theory originated within the Soviet psychology in the 1920s by its roots from the cultural – historical school of Vygotsky [9]. The theoretical framework was further developed by Leont’ev together with his students [10]. Leont’ev emphasizes the human activity as being a collective activity in opposition to Vygotsky’s human individual activity [11 p. 159]. Later this framework was applied and extended by Scandinavian researchers in mid-1980. The theory has continued to develop and expand ever since, which has resulted in several generations of activity theory [10], [12], [13], [14], [15], [16], [1]. Therefore, to better capture the fundamental understanding of the collective activity from Leont’ev’s work more explicitly, I have chosen to apply Engeström’s activity system model to locate the breakdown occurrences within the mediating relationships of the activity in context [12].
Activity theory built upon the fundamental beliefs that during history all human activity has been mediated by cultural tools when engaged in an activity [10]. Hence, the basic concept of activity theory is the human activity, which is the unit of analysis [8]. This relates to a reality view, which is socially constructed and where humans’ interact with the world by use of cultural tool(s). Each human activity has an object and it is the activity’s object that differentiates one activity from another [14]. The object varies in form and can be both from the material or ideal world [14]. The meaning behind a motivated activity is to change the activity’s object to accomplish an outcome [8]. The relationship between the subject and object is mediated by tools and signs i.e. technology, which are illustrated as a mediation triangle, see the upper triangle of figure 2. This central relationship within an activity of subject – object is placed within its basic context of the phenomenon under study, namely the community [13]. The relationship of subject – community is mediated by rules (i.e. laws, plans and norms). The relationship between the object and community is mediated by division of labor (roles, responsibility and power that colors the negotiations of distribution of tasks). A human activity is not static according to current plans of how an activity should evolve, but rather dynamic as plans change as the activity unfolds over time [17].

Figure 2 - Engeström’s structure of a human activity system showing contradictions in the system of a hospital (Copyright: Y. Engeström, 2000)

For a thorough description of activity theory see [1], [8], [10], [12], [13], [14], [15], [16], [17].
1.3 Data collection

The data collection is based upon notes taken during the initial field work including participant- and passive observations from formal and informal meetings with the in-house staff and system providers. My main concern has been to look for trouble situations including occurrences of failures and potential failures that the in-house staff fears as potential breakdown in the future. The Info-assistant is referred to as technology below. The Info-assistant is a touch based 12” digital screen, similar net board with Windows operative system (OS) which give access to all in-house welfare services. In addition, I refer to occurrences of breakdown that have occurred to the in-house safety alarm. Each apartment is equipped with one wireless safety alarm, and the elderly wear the alarm as a pendant around their neck. The safety alarm system is based on ultra wideband and covers the entire building of over 10,000 sqm and a promise of accurate positioning when triggered by the safety alarm wearer. A safety alarm user scenario is sketched below, see figure 3.

Figure 3 Illustration of a user scenario where the user triggers the safety alarm.

2 Analysis

The gathered material is analyzed and structured after elderly users’ activities by use of Engeström’s activity system model with regard to subject; tool; object; laws; community; and division of labor. The material is read in such a way as to find all the actions taken by elderly and the in-house staff including coping mechanisms for recovery as described from the staffs’ perspectives.

Using this framework, each occurrences of breakdown are sorted into degrees of breakdown such as complete; severe; medium; and minor related to possible critical outcome of breakdown including the risk of harming the health of the elderly users. The 11 activities are sorted in a short list as follows:
1. Technology displays blue screen of death (BSOD).
2. The safety alarm button is pushed but the alert signal fails to go off.
3. The safety alarm reports error locations of the person who pushes the alarm button.
4. Technology is interrupted after software update.
5. The technology fails working cause of flat battery.
6. Takeaway orders are both handled by technology and manually list.
7. Safety alarm is not working as its battery is flat.
8. Apartments for couples are only equipped with one individual welfare technology “package”.
9. User fails to interact within a touch based user interface.
10. Users misuse the safety alarm for other matter than critical situations i.e. social needs.
11. Welfare services are not working cause of unstable or failures in the network infrastructure.

The analysis consisting of sketches of Engeström’s activity system model is limited to selected activities 1, 3 and 6 due to space limit (see Appendix for a complete overview). The activities are explored within its minimal contextual frame, and are chosen to display that breakdowns vary in shape and severity.
A mediating artifact displaying blue screen or so-called BSOD has an outcome of severe breakdown as the consequence of non-access to the portal of all in-house welfare services (except the safety alarm) could harm the elderly in situation where important reminders or health monitoring are needed. Additionally, in this case of mediating tool / technology breakdown all the activity system’s mediating relationships are influenced by disturbances.

The subject is not able to transform the object into an outcome as long as the technology which is mediating the relationship of subject –object is out of order. Hence, the subject is not able to perform any action before the tool is repaired. The law mediating relationship between the subject and community has to change or be expanded for this special occurrence of complete breakdown as the laws are not per time covering such incidence of disturbance. Therefore is it necessary to implement new plans of actions and operations, especially for individual residents who are depending on critical welfare services accessible only trough the portal. Additionally, as the object is not transformed by the subject, the actors from the community have to re-distribute the division of labor as a coping mechanism to hopefully avoid the most critical outcome of the technology breakdown. In doing so, actors from the community call the system providers for support, in parallel actors will try to comfort
the residents while waiting for recovery. However, it will take some time before the community is alerted about the situation of breakdown, so there should be an automatic system that warns the system providers about the BSOD incident. Furthermore could the displayed disturbances within this activity system be avoided if some sort of technology redundancy of welfare services is implemented as backup. A critical matter in this situation of breakdown is that the net board as well offers users the functionality of mobile phone service. Hence, for some residents the net board could be the only access to phone functionality, so the only alternative for alerting about the breakdown is by use of the safety alarm, which would be a misuse of the safety alarm system. However, regular mobile phones out of coverage or battery have the options for emergency calls, and this should be the case for this net board as well.

2.2 Breakdown 3 - The safety alarm reports error locations of the person who pushes the alarm button.

A mediating artifact, the safety alarm, fails to report the exact position / localization of the person who has triggered the alarm to the alarm respondent system including the in-house staff in charge of responding to the safety alarm. This system breakdown is graded as a medium to severe breakdown as it could harm the health of persons in acute need of assistance. The breakdown is apparent by the disturbance of the
mediating relationships of the subject and the object, in addition to the object and the community. The disturbance influences the time it takes to assist the person who has triggered the alarm. Hence, if the person alerting is in his / her apartment, the staff is able to locate the person without further complications. However, if the person has triggered the alarm outside the apartment, the staff needs to search the building until they find the person in need of assistance. In cases of critical health issues, such as heart attack, this time lost could harm the health of the person who calls for help. However, as the safety alarm system is able to report the id of the person who has triggered the alarm, the alarm system is not complete failing.

The subject is able to perform the alert action by triggering the alarm button, but the safety alarm respondent system fails to report the exact location. Hence, the subject is delayed in transforming the object into the optimal outcome as the relationship is disturbed. Other mediating relationships are less affected as the object in the end is alerted, but need some extra time searching for the person who has triggered the alarm if he/ she are outside the apartment area. The object - community relationship is disturbed by re-distribution of tasks as a coping mechanism to find the elderly faster than by a solo performance search. Additionally, in a situation where the person is “lost” in the building, others from the community are called to help locating the person who has called for help. The disturbances displayed in this activity could be avoided if the safety alarm system had better coverage and scale of its position system.
2.3 Breakdown 6 - Takeaway orders are both handled by technology and manually list.

The tool mediated relationship of the subject and object is not experienced as usable for all the in-house residents. Some residents are not able to use the functionality of ordering take away dinner by interacting through the interface of the net board, which is the portal of all in-house welfare services. The breakdown is graded as being a minor breakdown; however it could as well be a medium breakdown if dinner was the only tasteful meal for the resident who potentially falls outside these two parallel ordering systems. However, this breakdown is first critical over a longer time period of lacking nutrition. Hence, the service of ordering take away dinner and get it delivered by the door is first and foremost for residents not in health of eating dinner in the cantina area. The in-house staff was made aware of this issue, and therefore developed an internal work around to compensate for the lack of technology flexibility. However, the in-house staff is worried that their optional manually system is complicating the work of the cantina personnel. Additionally, it is hard to know if some elderly in need of cooked dinner from the cantina for the sake of nutrition are suffering from not being caught up by the manual- and technology- based ordering system. This leads to disturbances within the relationships of subject - object, and the object – community as the residents interacts with the cantina personnel via the
technology. While the in-house staff supporting the residents are articulating work from the side by addressing selecting residents’ questions about dinner order orally. The disturbances displayed in this activity system could be avoided if the technology was useable for all the residents, which would result in a single dinner order list.

3 Discussion

The paper aims at looking for troubles and by this emphasizes merely problematic situations of welfare technology usage. Hence, in doing so the study rejects all the positive outcomes that have been experienced in the field concerning introduction of welfare technology, i.e. one resident experienced that he needed less medication by exercising regularly at the in-house circuit training. Additionally it is essential to emphasize that occurrence of breakdown by itself is not purely negative, as breakdown situations and their corresponding coping mechanisms for recovery is about learning and developing more robust welfare service systems.

3.1 Articulation work

Throughout the analysis it appears that in situations of breakdown including mediating artifacts, the artifact becomes the object as actors from the community step forward and re-distributes tasks by planning actions and operations as a coping mechanism while reporting, repairing or waiting for recovery. In this sense, a central shift occur in the mediating relationships of the object – community and the subject-community where actor(s) from the community take charge in being an active subject during the recovery process, and the mediating artifact becomes the object. This finding can be related to articulation work integrated in the cooperative nature of an activity. Schmidt and Bannon [18 p. 12] define articulation work as “a set of activities required to manage the distributed nature of cooperative work”. They further state that “in order to articulate the distributed activities of cooperative work arrangement, access to appropriate means of communication is needed.” [18 p.13]

Fitzpatrick, Tolone and Kaplan [19] claim that activity theory has a weakness in relation to CSCW research field as its lack recognition to the concept of articulation work. Fitzpatrick et al [19] recognize especially that “processes by which a community of actors articulate actions and operations in context, and develop (evolve) them in the face of contingencies are not well defined” [19 p. 6]. Fitzpatrick et al [19] argue that this may be due to the historical perspective of activity theory, which originally by Vogotsky [9] focused on the central tool mediating relationship between the subject and the object as a individual human activity. However, it has been several decades since activity theory was expanded by Leon’ev’s collective activity [10] and Engeström’s community [13]. Though, Engeström’s activity system model is not restricted from exploring the dynamics of the mediating relationships of the subject – community, as well as the object – community. Additionally has Engeström acknowledged actors from the community as being subjects in parallel
activity system, sharing other versions of the system’s object originally studied as unit of analysis [14]. However, as subjects from the community take place as an active subject to repair or compensate a failing mediating artifact, the mediating artifact become a object of a system; the subject might have conflicting interest in transforming the object into an outcome i.e. avoid breakdown in harming elderly or system providers who need to show they have delivered trustable technology. Nevertheless, are subjects from the initial activity system’s community an important resource in the re-organization of work practice as they articulate what need to be done during recovery. Findings in this study show that actors from the community who perform articulation work during breakdown situations typically are the in-house staff on duty i.e. the staff in charge for responding on safety alarm alerts. Therefore to strengthen the role of articulation work in a situation where it is critically needed, the law mediated relationship between the subject and the community would benefit from expanding the laws to include plans of actions and operations in situations of breakdown.

3.2 Challenges of designing innovation technology for elderly

The occurrences of breakdown within my field location are influenced by startup issues that often are present in an initial phase of regular technology implementations. Nevertheless are they important to analyze as the nature of failures is not restricted to the initial phases of a main welfare technology package implementation. The reason is that these breakdowns have occurred repeatedly; they are not easily fixed and are influenced by residents still moving into the building. To illustrate this matter; as more users/residents are moving into the building the technology is more fragile as it continuously has to handle a bigger amount of users.

Furthermore, it is assumed a high turnover of residents, which will lead to a continuous training process of new users that have to learn and adapt introduced technology. As a consequence, there will always be beginners in need of experiences to deal with potential breakdowns. Additionally are the introduced functionalities under constant upgrade, and it is planned to make several extensions to the prior implementation as the system vendors have already requested their client about adding more deliveries to their contract. Hence, this display the importance of identifying technology breakdowns during implementation phases as it enables the involved stakeholders to take actions to recover, prevent and hopefully reduce occurrences of failures to happen in the future. Though, introduction of welfare technology is still at innovation stage, and probably still will be the following years. This means that the use process of welfare technology might struggle with startup issues over time.

The concept of aging in place aims to extent the time living as independent elderly, and by this postpones the need for institutionalization, i.e. moving into a nursery home. However, the risk of getting health issues increases with aging so it should be
taken into account that a certain proportion of residents will have high turnover of living in smart homes. Consequently, while some elderly is in relative good health and have capabilities to learn and explore how technology can improve mastery of their daily life, others may have enough struggles merely coping during the day. The elderly who get familiar with the implemented technology as they learn over time and become skilled users might in the future experience that the existing technology is no longer supporting their user need. Though, they may suffer from temporary or more permanent health issues that challenge or change their need of support. I recognize this occurrence of mismatch between user and technology as technology breakdown as well, because users are experiencing incompatibility with technology, and their regular interactions with technology are interrupted as they may have forgotten how to respond or interact according to technology plans and instructions i.e. technology reminders concerning medication. This will require an upgrade or adjustment of technology to better support users according to changing temporary or permanent user need. One of the main challenges designing for elderly is to capture these varying user needs as their health conditions are likely to change over time, especially as they get older. An important question to address in this matter is how much dynamic can technology offer?

Ideally, welfare technology should be designed with high user flexibility i.e. options for picking user functionalities according to today’s user need. However, new features will demand that users spend time to learn how these services work. Though, as elderly are aging they might find it harder to use technology and be more reluctant to learn. I argue that at some point, elderly should be released from learning new technology as they at some point will fail to keep up with constant introduction of new welfare devices. However, it is not easy to predict when the maximum benefits of welfare technology usage are achieved. I argue that if breakdowns occur more and more often as a result of lacking user ability to keep up with new or existing technology, it can be an indicator that it's time for these elderly to be freed from usage of demanding technology. As some elderly living in smart homes will at a given point have needs beyond what home nursing and technology can support. These elderly might be more comfortable living in a staffed nursery home because of their safety. However, other elderly might find use of more automated welfare technology valuable. Technology such as artificial intelligence (AI) could offer elderly improved automated services, and use of such technology demand less effort from its users. I claim that use of AI for some critical welfare services could give elderly improved technical services, if designed properly. Hence, use of AI will reduce the pressure of users’ responsibility of constantly being compatible and updated on new improved services. Furthermore, introduction of AI could as well reduce the risks for technology breakdowns, as less need for interaction minimizes chances of interruptions. AI can be designed and pre-programmed to operate strictly according to the planned actions, independent of input from users.
3.3 How much trust can we put in technology mediated relationships?

Technology mediated relationships have always a potential of failure – especially are new ones fragile and vulnerable for interruptions or disturbance. In this paper’s context, the technology mediated relationships are involving complex systems of (possible) laypersons and technology interactions, which hardly can be completely trustworthy as unfaultable. However, an organization or system that over time learns new practice of doing things will get more experienced as actors of technology mediated relationships, and by this as well will learn to better deal with coping mechanisms to avoid the most critical outcomes by working around breakdown situations. Nevertheless should design of welfare technology include option for override of technology as a built-in coping mechanism to avoid the most critical breakdown situations. Additionally should purely technical services for health monitoring or safety purposes always include redundancy as precautions. Though, the introduced welfare technology at the field location of this study has in-house staff, so the in-house staff is an essential resource to back up situations of breakdowns. However, the health authorities have ambitions about bringing welfare technology into regular homes of elderly aging in place, and not only into dedicated buildings for elderly only. Therefore, it is a need to explore how introduction of welfare technology can be achieved in regularly homes, and still have the same option for alternative “in-house” backup solutions. Hence, Scotland has had great success by their call-centers who guide callers according to their need. The call-center function might work as an “in-house” staff solution for elderly in regular homes, calling or automatically alerting about occurrences of breakdowns. Nevertheless, elderly should receive information about potential contradiction of welfare services, and in addition be well trained in workarounds plans in cases when system fails to support new practice of work.

3.4 Applying activity theory

By applying activity theory to explore human activity systems and its components explicitly, I was able to analyze the social-technical dynamics of breakdown situations in context, in opposite to a purely technical viewpoint that was initially the case. Additionally it was found useful to analyze breakdown in an activity system perspective as elderly interacting with welfare technology is hardly an isolated usability issue. These elderly are depending on their welfare service respondent system i.e. the object, as well as their community in which they operates within including home care nursing, system providers, shops, regular GP, hospital, family with more. I find Engeström’s activity system model especially valuable for exploring what happens in the system’s dynamics when one of the mediating artifacts fails. Furthermore, applying activity theory was useful for capturing the force that occur within the systems i.e. study the adjustment, work around or coping mechanism to avoid the worst possible outcome of breakdown or to accomplish some sort of transformation of the object to a more or less satisfactory outcome. I have compared
various breakdowns and recognized that some breakdowns could be fatal, in the meaning of harming the life and health of elderly if not working. These situations of breakdowns are not acceptable, and I refer to them as complete breakdowns, in some way comparable to Heidegger and his “purely present at hand” [3] or Bodker [7] recognizing breakdown in relation to the use processes of activities that are disturbed or not acting as planned. However, Koschmann et al [4] refer to activity theory in relation to breakdown as being a dichotomous phenomenon. This differ from my findings where I have situations of breakdown that are perceived as serious error situations, however they vary in degree in relation to their potential of harming the health of the elderly. Though, some breakdowns could harm the safety of the elderly, while other breakdowns are minor and rather troublesome errors than critical. Additionally is the outcome of the activity system and the coping mechanism to work around the breakdown different from other Activity theory and HCI studies of breakdowns. I therefore recognize a need to introduce a grade system that reflects the possible outcome of the system’s error. The situations of breakdown are therefore categorized as complete-, severe-, medium or minor breakdown. A common attribute for all of these breakdowns were the recognition of articulations work as an essential response or coping mechanism while recover from breakdown.

The chosen framework of activity theory restricts the contextual frame of the activity as its focus primarily on the included components within Engeström’s activity system model [12]. However, a study needs to be bounded or narrowed in scope of the problem situation as it is impossible to grasp a real world phenomenon with all its complexity. Nevertheless is Activity theory recognized as the most appropriate theoretical framework for this study’s unit of analysis, when I aim to study breakdowns in activity systems, especially concerning laypersons’ usage of technology.

4 Conclusion

In this paper I have applied the theoretical framework of activity theory, and especially recognized the work of Leont’ev [10] and Engeström [12], [13] to identify and understand occurrences of breakdown of welfare services within the contextual frame of elderly welfare service users. In doing so I was able to analyze breakdowns and the degree of breakdown in-situ, and plan required actions to be taken for recovery. The study displays that in situations of breakdown, actors from the community have to articulate work tasks as a temporary coping mechanism while recovering from the breakdown situation. However, to better succeed in the ambition of delegating selected welfare services to technology, it has to be a strict requirement that both technology and its infrastructure must be robust. Otherwise, can complete- or severe situations of breakdown in worst cases result in critical harm of the elderly users.

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Appendix: Overview of the results from the analysis of breakdowns.

Table 1. The table displays an overview of breakdowns situations experienced at the field location. Additionally the table list type of breakdown and the corresponding coping mechanism for recovery.

<table>
<thead>
<tr>
<th>Breakdown</th>
<th>Type</th>
<th>Coping mechanisms for recovery</th>
</tr>
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<tbody>
<tr>
<td>(1) Technology displays blue screen of death (BSOD).</td>
<td>Severe breakdown as loss of access to portal of all welfare services may result in harming the health of the elderly. The breakdown occurs within the operation level as user is not able to carry on with any operations as access to portal of all welfare services is lost.</td>
<td>Actors from the community alert the system providers about the situation of breakdown. Elderly should not be expected to recover from BSOD as occurrence of BSOD should be left for the technical staff. However, the technology has solution to recover in safe mode, so skilled users may start Windows in a limited state if access to services are critical needed. In addition, the net board has several functionalities included, i.e. option for making phone calls, which could be of value in cases of acute emergency when user has to make an emergency call for assistance. It is not possible to bullet proof technology to not experience BSOD. However, by regular maintenance of technology will reduce the risk of BSOD occurrence. Technical staff should as well have the possibility to offer remote support so the situations of BSOD can my fixed within short time range.</td>
</tr>
<tr>
<td>(2) The safety alarm button is pushed but the alert signal fails to go off.</td>
<td>Complete breakdown as elderly in need of emergency assistance is not able to alert, and by this get help in possible critical situation. The breakdown occurs within the operation level as failures in network infrastructure restrict access to services.</td>
<td>Actors from the community respond if the person is absent over time. As well as they alert the system provider to repair the breakdown. Ideally, networks that serves critical services like alarm systems should for the safety of the users be delivered with guarantee of 24/7 uptime or infallibility. In addition, should network providers make throughout plans and tests including risk analysis to avoid situations where services are put down cause of network errors where in worse cases users get harmed. Therefore, providers together with the technical staff regularly do system evaluations’ of previous user scenarios for improvements. To prevent networks that fail to serve the services that it is supposed to serve, it require that for security response the delivery should include network redundancy. Hence, if one network goes down, the backup network takes over and serves its users until the main network has been recovered.</td>
</tr>
<tr>
<td>(3) The safety alarm reports error locations of the person who pushes the alarm button.</td>
<td>Medium – severe breakdown as the safety alarm fails to report the localization of the person who has triggered the alarm button. In critical situation</td>
<td>The person who has triggered the alarm button could be found if located within his/ her apartment. However, if the person in need of assistance is outside the apartment, and is not found within relative short time, actors from the community has to support the alarm responder in charge in searching for the person in need. If the alarm system is supposed to support the security of the elderly by use of a localization alarm system, the system</td>
</tr>
</tbody>
</table>
of health issues, the respond time is crucial. The breakdown occurs within the operation level as failures in localization features restrict precisely positioning. needs to be upgraded in coverage and scale to better secure users. As a backup solution, the alarm devices should have a two-ways communication feature so the users and staff have options for communication to better get overview of the situation. Get extra funding / resources to upgrade the alarm system’s localization features both in coverage and scale.

(4) Technology is interrupted after software update. Complete or medium breakdown, depending on the need for accessing welfare technology. The breakdown occurs within the operation level as system updates throw the users out of their regular user interface. The users’ experiences lack of access to their welfare services. Actors from the community are alerted by residents concerning the failure, and by this are able to alert the system provider and temporary support the residents in need by alternative manners.

The users have to navigate the user interface to locate and start the welfare software application. In addition, this requires users entering user name and password.

The system provides could add a setup script after update and restart of technology, for automation of startup and login of welfare software application OR the users could log in to the device and application by use of finger print or by scanning their door card with more.

(5) The technology falls working cause of flat battery. Complete or medium breakdown, depending on the need for accessing the welfare technology. The breakdown occurs within the operation level as flat battery is temporary, but complete breakdowns as access to their welfare services is lost. Actors from the community are alerted by residents concerning the failure. Actors from the community help residents in doing the plan activities manually or by helping them diagnosing the failing technology as being in need of battery charge and by this support elderly in placing the technology into the battery station.

The users have to put the net board into the docking station. Wait until the net board has achieved enough power to start again. As the net board is turned on, the net board will load the windows OS desktop and the user has to navigate to its welfare software application, start the application and login with their user name and passwords.

The system provides could add a setup script that reloads the welfare software application after startup of technology for automation of startup and login of welfare software application. The technology should communicate within an acceptable time spend ahead of battery going flat. Hence, users could put the net board into the docking station in time before the technology goes down. The net board should be equipped with robust battery that has long lifetime. Users should maintain their battery with regular calibration to extend the battery’s lifetime.

(6) Takeaway orders are both Minor breakdown as lack of access Actors from the community have a manually system for the residents who are not able to order dinner by use of
<table>
<thead>
<tr>
<th>Handling by Technology and Manually List.</th>
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<tbody>
<tr>
<td>The dinner order system should result in one main list for the ease of staff working in the cantina. In doing so, potential disturbances may be avoided. Such a system may also affect residents who are not captured as being unable to order dinner by technology. In existence of two alternative ways of order dinner some residents are likely to slip, and these are likely to be the most vulnerable ones.</td>
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<th>(7) Safety Alarm is Not Working As Its Battery is Flat.</th>
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<td>Complete or medium breakdown, depending on the need for triggering the alarm button. The breakdown occurs within the operation level as an alarm with flat of battery is an alarm not working.</td>
<td>Residents alert actors from community about the flat battery. Actors from the community visit resident to check if something is wrong if residents have been missing over longer time. Carry out regular test routines, to check if alarm is working. Change battery within the battery is due, rather than wait for the battery to go flat. If a battery has an expected lifetime range, the battery should be change in time before the expected time range expired. Upgrade alarms to include LED that display if battery has power or if the battery is flat. In addition, the battery should be locked robustly, but the number of requires screws should be kept to a minimum for the ease of maintenance.</td>
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<th>(8) Apartments for Couples Are Only Equipped With One Individual Welfare Technology “Package”.</th>
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<tr>
<td>Complete or medium breakdown, depending on the need for triggering the alarm button for the one who lacks welfare service support. The breakdown occurs within the operation level as one person lack access to welfare services, so he or she is not able to perform any actions.</td>
<td>The couple should be equipped with equal access and individual welfare technology packages. Acquire and equip the one of the couples that lacks access to individual welfare technology.</td>
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<th>(9) User Fails to Interact Within a Touch Based User Interface.</th>
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<tr>
<td>Complete breakdown for persons who are not able to interact and by this take use of technology.</td>
<td>Residents who lack access of technology for various reasons will deal with this breakdown by manually doing the services themselves or they will contact actors from the community who will do the actions for them. Per time there is none actions that could be taken for</td>
</tr>
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any in-house welfare services.

The breakdown occurs within the operation level as one person lack access to welfare services.

Recovery. However, the system needs upgrades of functionalities.

Upgrade net board to include universal design i.e. options for enlarge text fonts and text types, audio for text. Interact with technology with use of voice controller.

(10) Users misuse the safety alarm for other matter than critical situations i.e. social needs.

Minor breakdown, which could have potential of harming the user in a critical situation, in cases when the alarm responder need to make prioritization of whom to respond first.

The breakdown occurs within the operational level as users misuse the function of the given welfare service.

Actors from the community has to talk to users who trigger the safety alarm buttons as they feel lonely or have other social need that not should be mediated by use of safety alarm. Actors from the community have to bring in other professionals in cases of mental disorders for support.

The safety alarm staff has to inform the user about the intention of safety alarm usage to avoid staff down-prioritizing miss-users of safety alarm in situations where miss-users might have a critical situation.

The users should be informed to use other communication’s channels for social need or purposes.

(11) Welfare services are not working cause of unstable or failures in the network infrastructure.

Severe breakdown as access to welfare services by this are unstable, which could harm elderly in need of support of i.e. health monitoring.

The breakdown occurs within the operational level as users are lacking infrastructure and by this access to welfare services.

Actors from the community are alerted by residents about unstable or service out of orders. Actors from the community alert the system providers.

The technology is based on wire–less network infrastructure, and in situations of unstable or failures in the network infrastructure the technology is not working.

The system provider needs to be contacted for support. The network vendors have to do radio wave measurements to achieve an optimal network infrastructure.

It is recommended that a network that serves critical welfare services should have redundancy to maintain a robust network.
Abstract. According to WHO, 50% of chronically-ill patients do not follow treatment guidelines. One way to promote commitment to care and treatment is empowerment. In this paper, we present an idea about an empowering process that 1) awakes the citizen to see that health-related change is needed (a fracture) and 2) brings up the motivation to achieve that change (a goal-oriented action). This process may be supported in different ways, for example with information technology. This supportive tool, however, needs to focus on the needs of citizens, not on the needs of healthcare professionals, in order for it to be truly empowering. Thus, a citizen-centric approach is needed. In the Coper-pilot, a sub-project of the EU-funded Pump-project, this approach is adopted. The concept of Work Informatics is used as a framework for research, with the goal of creating citizen-centric information systems that support goal-oriented actions of citizens to promote patient empowerment.

Keywords: Coper, Citizen-centric, Motivation, E-health, Cardiac patient
1 Introduction

Modern health care is facing different challenges, or should we say problems. It is worth of notion that already over three decades ago the problems were almost the same. Already in the 1980s, Andre De Vries [1] was pointing out problems of healthcare: problematic relationships between patients and doctors, patient anxiety and revolt, dehumanization of medicine, societies having financial difficulties with healthcare expenditures, over-treatments, problematic healthcare distribution etc. De Vries was pointing out that people should take responsibility of their own health, as they are free rational agents of society. However, before people can take the responsibility, there are some requirements to be fulfilled. First, there must be patient autonomy. Without autonomy of the patient there obviously cannot be responsibility. Secondly, people must have a right for care and treatment before they can be held responsible for their health. Third, people must have information. Without understanding one cannot have plausible responsibility. [1] Today, we are facing similar problems to those described by De Vries, and we must bring citizens to be active actors of their own health and well-being. Thus, we must change the approach to how health and illness is faced; those cannot be put behind the veil of medicine if the change is wanted.

In this paper, we have three major points to present. First, the premises of citizen-centric approach are introduced as a justified and solid ground for altering the current situation to a better one. The definition of health as “homelike being-in-the-world” by Svenaeus and “Salutogenesis” and “Sense of Coherence” as a view of well-being from Antonovsky are used as a new approach in the on-going Coper-pilot. [2] Secondly, the Coper-pilot and Work Informatics approach are presented. The Coper-pilot is a citizen-oriented project that is using the concepts of Svenaeus and Antonovsky as a starting point. The Work Informatics approach is used as a development framework that emphasizes social aspects of using information technology. Thirdly, the terms fracture and goal-oriented action are introduced. These two terms are used to bring forth the multi-dimensional aspects of patient motivation when trying to achieve patient commitment to care and treatment. Fourth, we will present some observed needs of citizens, especially concerning e-health solutions for citizens. The focus is on citizens with some cardiovascular disease, the target group of the Coper-pilot. At the end, there are some conclusions.

2 Ideological Background

The ideological background is based on the problem that WHO has presented; 50% of patients in Western countries do not follow treatment guidelines they have received [3]. This is clearly a problem and it is not solved with more direct orders from doctors or by adding more medical guidelines. We must see the needs and experiences of the people and figure out the way to increase the willingness of those people to commit to their care and encourage people to take an active role in improving their own health and well-being. In order to be able to do this, we must have some understanding and definition about health and well-being in the context of individuals. We are using the findings of Svenaeus and Antonovsky as a background to our approach.
Fredrig Svenaeus is a philosopher of medical ethics whose work has been heavily influenced by the Heidegger’s Phenomenological view. While Heidegger was focusing on the subject of a being itself, Svenaeus [4] is focusing more on people’s health and the meaning of medicine in people's lives. Svenaeus defines health as a homelike being-in-the-world and describes the patient as a person who has an illness and who seeks help. [4] For gaining better understanding of what means homelike being-in-the-world, it is fruitful to look at the other side of the coin; what it is to be ill. The concept of unhomelike being-in-the-world is also a concept of Svenaeus[5]:

“Health, in contrast to this frustrating unhomelikeness, is a homelike being-in-the-world in which the lived body in most cases has a transparent quality as the point of access to the world in understanding activities.”[5]

Illness is something that alienates one from one’s homelike being-in-the-world. It means that one’s future and past seems to be alien, while compared to what it was before the illness. Alienating can be seen as alienating from one’s body, in the context of phenomenology of medicine. Nevertheless, the alienation from the body is not sufficient for understanding the phenomenology of illness. The alienation from homelike being-in-the-world is a wider conception where illness is seen in a broader way. Illness is a critical change in meaning-structure within the self (the person) and the self is not identical with the body of a person. It is also possible for one to gain homelikeness back without the disease (that is biomedical) being cured and thus illness is something that is temporally alienating from homelike being-in-the-world.[5] Like Svenaeus was showing, health and illness are very personal by nature and we must always understand the individual experience of those (which differs from person to person). Thus, we must try to find ways to support one’s gaining of the health in a sense of homelike being-in-the-world, not only in a medical context.

Antonovsky [6] is highlighting the need for a different concept than pathogenic orientation (a view that is focusing on diseases and bio-medical factors) that is dominant in the current medical research and healthcare. Salutogenetic model that contains the concepts Sense of Coherence (SoC) and General Resistance Resources (GRRs) is a model in which the focus is on supporting health and well-being by focusing on salutary aspects and seeing the entire person rather than just the disease or illness. Antonovsky sees that health is a continuum where in the other end is health and in the other is illness. Each of us is in some place along that continuum in some specific time. [6] There is a similarity with Svenaeus’ homelike being-in-the-world [4] that also was time dependent; it is altered by time. The main point in both Svenaeus’ and Antonovsky’s works seems to be that people are persons and they cannot be treated as mere medical objects. Moreover, people must be supported in such a way that they can have meaningful goals and ways to achieve those goals. In the Coperpilot, this kind of approach is put in operation and chapters four and five are dealing with this issue.

Thus, people experience their health or illness in different ways and in different situations people have different needs and desires [7]. Like Svenaeus is pointing out, there is very much variation in people’s experiences of health. Hence, it is obvious that the people themselves are the best experts of their life, because they are living it. Even if healthcare professionals or some other people could possess a greater amount of information about the sicknesses and body of a human being, they are not living the life of the people having those diseases. Healthcare professionals should be
serving the needs of the patients rather than only giving them paternalistic solutions from the perspective of a professional. Patients should have the experience and the feeling that there is “Nothing about me, without me” [8].

3 Work Informatics as a Research Framework for the Coper-pilot

The Coper-pilot (2011-2014) is a sub-project of a bigger EU-funded Pump-project that aims at developing well-being services to citizens. The pilot is carried out by a research team from University of Turku and co-supported by City of Turku, CGI Inc. and Turku Science Park Inc.

In the Coper-pilot, the focus is on patients with a cardiovascular disease living in the Turku municipality area, Western Finland. The purpose of the Coper-pilot is firstly to clarify the vision created in the Pump-project, a vision of a citizen that takes on a more active role in their health and well-being. Secondly, the pilot aims to deliver citizen-oriented e-health services that actually meet the needs of patients with a cardiovascular disease. The main goal is to define requirements of the patients from human-scale information system perspective. In order to reach these goals, principles from Work Informatics are applied.

Work Informatics is a multi-disciplinary research area (at University of Turku, Turku School of Economics, Information System Science) that seeks to solve problems in information systems development by approaching issues from a social perspective. Thus, the focus in Work Informatics is on different dimensions of work, such as individual and collaboration work. Furthermore, the phenomenon related to work cannot be studied in a laboratory environment, because work is a social construct and thus, a more social approach must be utilized.

The main thesis of Work Informatics is the concept of inseparability of work and information systems. By this we mean that data processing activities cannot be isolated from other activities, not even for the purpose of designing information systems. This derives from the concept known as the inseparability postulate that states that an information system cannot be altered without altering the organization it is related to. Likewise, the organization cannot be altered without altering the information system. [9]

In Work Informatics, information systems and their activities are seen to be unconditionally rooted in the activities of human beings. That is, the computer is not seen as an artifact that has a meaning in itself. In other words, a computer cannot do anything on its own because there is always human activity behind an action. This being said, the computer is only a tool of human activity. [10] With this principle in mind, we now have excellent guidelines for solving problems in real world such as those in the Coper-pilot.

The theoretical foundation of the Coper-pilot is taken from Work Informatics. As stated before, focus in Work Informatics is on work processes. Since the focus group in the Coper-pilot is a group of patients with a cardiovascular disease, the concept of work needs to be revisited. Merriam-Webster Encyclopedia defines work as “an activity in which one exerts strength of faculties to do or perform something”. While this is a working definition, it however does not completely apply in our case. For a
better understanding of the concept, we interpret work as a goal oriented action. Let’s take a patient with a cardiovascular disease performing daily tasks related to their condition as an example. Here the action of performing the task to maintain the condition is driven by the prospect of a better health. By applying principles from the Work Informatics framework we seek to get an understanding of the phenomenon taking place in the patient’s context.

4 Fracture and Goal-Oriented Action

Patient participation is very important in health care. Without patient commitment and adherence to treatment the desired treatment outcomes are very hard to achieve. In order for us to understand patient commitment and adherence to treatment, we have to consider the issue from the patient’s point of view. This way we get insight into a particular patient’s characteristics and needs affecting health related issues and motivation to treatment. By understanding the patient’s point of view, we may be able to affect his commitment and adherence to treatment.

The self-determination theory is one theory that considers behavior change and motivation of a human being. The theory has been used in health care to understand the motivation of patients, for example to treatment adherence. By using the principles of Self-determination theory in health care interventions, the achievement of health advancing goals and the autonomy of the patient may be supported [11-13]. Self-determination theory sees motivation as a continuum from amotivation to extrinsic motivation to intrinsic, self-determined motivation. The theory sees intrinsic, self-determined motivation as the most sustainable type of motivation, as behavior that is interesting and pleasant in itself is intrinsically motivated. Also, intrinsic motivation is the most autonomous form of motivation, as the amount of autonomy grows when moving along the continuum towards intrinsic motivation. But, when thinking about health care and actions that it requires from the patient, it may be recognized that these actions in themselves aren’t necessarily interesting or pleasant for the patient. So, instead of seeing motivation solely as intrinsic motivation situation should be seen as these actions can also be enchanted by extrinsic motivation. Therefore, as intrinsic motivation is seen as the most sustainable type of motivation, one should attempt to reach a type of extrinsic motivation that resembles intrinsic motivation the most. [14] For example, in the Coper-pilot project we are looking reality from the perspective of the citizen [2]. Citizens in this context are seen as wider than the mere object of healthcare; they have their own lives outside of role of the patient. Citizens have rights and duties and thus citizen must be treated as the active actor of their own lives and wellbeing. If people are merely treated as objects of healthcare how they can be excepted to take care of their health and wellbeing. This reality is in its optimal state when the citizen is feeling “homelike”, as presented in chapter two of this paper. But sometimes this reality may be fractured. This fracturing can be caused by a big, surprising and especially unpleasant change in the state of the citizen, the surrounding interaction partners, or the surrounding environment. If this change is coupled with a profound acknowledgement of its existence, a fracture is created. A fracture causes contradictions between the present state-of-being and the objective state that is based on one’s own values. These
contradictions and the unpleasant feeling caused by the fracture may lead to a goal-oriented action.

A goal-oriented action is purposeful and determined functioning leading towards one’s own personal goals and objectives. The purpose of this action is to fix one’s state-of-being caused by the fracture, and to restore the optimal state of feeling homelike. A goal-oriented action is characterized with persistent efforts to overcome the contradictions and barriers between one’s present state-of-being and the desired objective state-of-being. This necessitates that one experiences the fracture as such a significant change that one wants to fix this unpleasant state-of-being caused by it. In addition to this, a goal-oriented action may occur only if the citizen believes that reaching the desired objective state is overall possible. The citizen must also trust in his own capabilities in achieving the desired objective state. When thinking about goal-oriented action as described above, we can easily see that performing and engaging in goal-oriented action requires motivation from the patient’s behalf. But as the fracture in itself isn’t that interesting or at least not that pleasant, the motivation is hardly only intrinsic. Instead, the motivation of a goal-oriented action can also be extrinsic.

As stated before, one should attempt to also reach a type of extrinsic motivation that resembles intrinsic motivation the most when trying to achieve the most sustainable form of motivation possible in actions that can’t be only excepted to be intrinsically motivated. Self-determination theory recognizes that the development of motivation and one’s own personality are based on human being’s innate tendencies to psychological growth and to the integration of the self. The theory recognizes three psychological factors that enable these innate tendencies, and the development of motivation: competence, autonomy and relatedness. [14-16] These three factors are recognized as human being’s basic needs, and supporting these needs is pivotal for motivation [15]. Competence implies that one needs to believe in his own capabilities to affect outcomes in order to be motivated. [14, 17] Also, one needs to have autonomy instead of feeling compelled by someone else to act in a certain way [14]. When having autonomy, one feels that he himself is making the decisions regarding one’s actions [17]. Relatedness refers to one’s social environment and connections to other people. According to the theory, one has a natural tendency to feel connected to, to be supported by and to be understood by other people. [16, 17]

So, in order to be able to develop the extrinsic motivation to the most sustainable form possible, the three factors affecting motivation – competence, autonomy, and relatedness – have to be supported. Especially the support of autonomy is seen very important when considering motivation for health related activities, since it has been recognized that autonomous motivation has resulted in better treatment commitment and adherence. These in turn result in better treatment outcomes. [14] Kosciulek and Mertz [18] have shown that people’s power over their own rehabilitation has a positive relationship with empowerment and further, there exist a positive relationship between empowerment and quality of life.

There are several ways to support patient autonomy. First of all, the patient’s point of view of his own health conditions, the disease and its treatment should be recognized, considered and understood. [19-21] Secondly, the patient should be offered several different types of treatment possibilities, from which the patient may select the one that suits him the best [18-24]. The patient should also be encouraged to
use his own initiative by encouraging him to take part in the decision making regarding issues affecting his health [20-22]. Because people are the experts of their needs and how these needs are best met, they should also have opportunity to exercise control over their daily lives [18, 23-24]. To enable this, the patient should be given information about the disease, treatment and the effects of his own actions [19-22] and moreover there should also be appropriate long-term support available [18, 23-24]. In addition to these, the patient shouldn’t be pressured to act in a certain way. Instead, by supporting the patient’s autonomy, he should be allowed to make the final decision as how to act.

When considering motivation from the point of view of Self-determination theory, it is quite clear that the patient’s needs related to health care and the homelike-being are taken into consideration. By supporting patient’s feelings of competence, autonomy and relatedness, the patient’s own point of view to his health conditions and his motivation to take necessary actions to improve his health are recognized. Using the principles of Self-determination theory could therefore be quite valuable when developing healthcare interventions that truly want to consider the patient and his feelings and also answer to the patient’s individual needs.

5 E-health for the Citizens

5.1 Coper pilot

In the Coper-pilot, the development of the e-health services is based on the citizen’s point of view. The pilot seeks to reply to the on-going national agenda in Finland that emphasizes the importance of self-care as well as the utilization of IT in providing health services, and the present problems in the efficiency of public health care. The purpose is to find out whether e-health services could help in solving the existing problems and needs. We are focusing on how to get and enable patients to take on a more active role in their own health care, and what are the mechanisms behind the motivation to do that. The aforementioned concepts of fracture and goal-oriented action are used as the basis of our approach in the Coper-pilot.

5.2 Pre-evaluation study

In 2012 a pre-evaluation study was initiated. The study was conducted as part of the Coper-pilot and the aim was to investigate the needs of patients with a cardiovascular disease towards e-health services. In the study it was discovered that the patients have multi-factorial needs for e-health services [25].

5.2.1 Participants and data collection

All participants were recruited outside the hospital. The target group consisted of seven participants. Individuals were selected in random manners. Ages ranged from 60 to 88 years. The type of the cardiovascular disease was not of high importance, since the purpose was to study cardiac patients as one group in whole. Eligible
participants were approached personally and both written and verbal consent obtained from those who agreed to participate in the study. [25]

Data was collected using thematic interview method and themes were derived from the research question. These themes were: needs and preferences, prior experiences with e-health services, benefits in daily life, use of e-services, challenges and motivation. Participants were interviewed once and all interviews took place at their home except for one which took place at University facility. Interviews lasted from 45 to 100 minutes. Interviews were auto taped with participants consent and afterwards transcribed. Transcribed data accumulated up to 74 pages. [25]

5.2.2 Main results

The most important needs were categorized as follows: need for information, communication, social support and self-care. Need for information was one of the most important themes discovered. This theme was further broken into advisory, counseling and access to reliable information. Participants wanted information about different states of pain, medication, symptoms, daily life and information related to recovery. In addition, participants hoped for an easy access to information. [25,26] Forster et al. [27] discovered that information provision improves patient’s knowledge of their condition and can increase patient satisfaction. They also found that information provision has an effect of reducing patient depression. They, however, add that information provision should be continual, since it has more effect then. Health portals offer tools to fight the gap in information provision by enabling access to different information [28].

The second need discovered was the need for communication. The participants had experienced difficulties related to communication with healthcare professionals. Many experienced that they were not given a chance to participate in their care. They felt that they were underdogs and outsiders in their treatment. [25,26] While paternalistic behavior can be benevolent and well intentioned, it does have an effect of creating and maintaining an unhealthy dependency towards health care professionals [29]. The need for a trusting relationship between doctor and patient and the need for trust in the medical system as well, seems to be of critical importance for the patients, in order to communicate electronically with their doctor. In addition, communication via computers also affects the level of trust that the patients experience in their doctor and their willingness to sustain their relationship. The informality and the personal language used in the e-mediated communication are examples of such elements that can stimulate the trust in patient-doctor relationships. When a trusting relationship exists, e-mediated communication offers the patients an opportunity to contact the doctor when and where it suits best for each personal life circumstances. The patients value this kind of communication because it is a relief that they can tell prevailing worries to their doctor. The use of e-mediated communication can also enable them to ask such questions that they would not otherwise brought up. [30]

Social support was also an important theme, though perceptions about it varied. For some, support from family was the most important. For others, support from the
outside or personal support was better. Participants, however, all agreed that support is important. It does not matter whether it comes from the family or from outside. Based on this, eHealth services could be a source of social support for the citizen. For example, studies focusing on patients with breast cancer, arthritis and fibromyalgia suggest that participating in online support groups can create a feeling of emotional support. It appears that participation in online support groups can generate empowering processes and outcomes related to social and emotional support, such as increased social contacts, enhanced social well-being, avoided social isolation, finding recognition and understanding and feeling less lonely in coping with the disease.

Self-care involves regular maintenance tasks such as managing multiple medications, engaging in physical activity and healthy diet follow-up. Participants showed interest towards time management, document management, medication management, monitoring and health management. Time management was important to many. This included calendar and reminder features through which one could follow and plan tasks. Successful rehabilitation means changes in relationships between an individual and his environment. Those changes are results of goal-directed action, and amongst other things, it manifests itself by simplifying daily life. When a citizen is trying to make a difference to their health-related behavior, health care professionals can assist their effort effectively via new technologies. For instance medication management, self-management skills, and patient experience with care can be positively affect by the use of health IT applications. Automatic reminders and personal messages, which take one’s prevailing life contexts into account, are examples of such health communication solutions. A citizen, who receives tailored lifestyle information about nutrition behavior or physical activity, is more likely to meet the guidelines than a citizen who receives only generic information.

5.3 Current study/Situation

At the moment Coper-pilot study is in progress and it is in data collection phase. We have selected citizens with some cardiovascular disease as the target group of the pilot. For a patient with a cardiovascular disease, the fracture is quite obvious: the disease itself. Our purpose is to find out the mechanisms needed for the citizen having a cardiovascular disease to be empowered and motivated to commit, participate and adhere to the needed treatment, that is, how to get the citizen to engage in goal-oriented actions that would fix the fracture. In addition, our aim is to find out the mechanisms to help the citizen live his own everyday life that includes the cardiovascular disease in the best manner possible, and how to get the citizen to the homelike state-of-being described in chapter two. We believe that e-health services could provide solutions that help the citizen live his own everyday life with the disease as well as, when correctly developed, could enable and motivate him to take a more active role in his own health care.
6 Conclusions

It is obvious that if we want to change the problem of half of the patients not following treatment guidelines we must change something in healthcare. One solution, that seems to be promising, is to give more focus on people’s experience of their health and well-being. We must understand that no given orders from doctors or other healthcare professionals are effective if people do not follow them. By respecting peoples’ autonomy we can find ways to motivate them so that they will themselves be the core actors of their own well-being and health. However, there must be tools (in this case, e-health solutions) for people to take that control, and information technology can be one of those tools. The tools must be designed and implemented in such a way that those tools fulfill the needs of citizens, not only the needs of the healthcare system, or we will face the prominent problem of non-commitment of citizens. In the Coper-pilot this citizen-centric approach is taken as a core value for achieving better e-health solutions.
References


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The ambiguous photocopy machine – a story about designing for development

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Abstract. The intention of this paper is to stimulate reflection on certain issues regarding design of ICTD concepts by telling a story about a pilot project in rural Bangladesh which included a telecenter. I will suggest that in telecenter design, viewing ICTs as primarily information processing and communication enabling artifacts may conceal other functionalities that users may find more relevant for their strategies to improve their living conditions. Functionalities I will term “off-web attributes”, such as copying, printing and transfer of digital content may be more valued than “on-web attributes”. I will suggest that telecenter design should review the existing communication- and information infrastructure of the community, and that Margunn Aanestad’s design metaphor ‘design of configurations’ may be particularly useful for telecenter design.

Key words: ICTD, design, telecenter, mini-grid, Bangladesh
ICTD - designing for development

The aim of Information and Communication Technology and Development (ICTD) initiatives is to improve the living conditions of people in low-resource contexts by mean of giving them access to ICTs. A central idea in the ICTD field is Amartya Sen’s capability approach where poverty is viewed as a condition where individuals are deprived of the freedom to live productive and creative lives (Sen 1985, Avgerou 2010). Development is thus to achieve the opportunities and freedom to utilize one’s capabilities for living such lives (Sen 1985). ICTD design often implies envisioning ICTs as tools people can use in this regard, for instance by utilizing your capability for learning through accessing educational content or utilizing your capability for providing for oneself through accessing information about the market where you sell your products. However, many ICT4D initiatives fail to bring about the intended changes in people’s lives (Heeks 2002, Avgerou 2010). Richard Heeks focuses on the processes of design in his analysis of ICTD failure. He argues that a major cause can be found in what he terms the design-actuality gap. He conceptualizes a gap between what he terms ‘local actuality’, which is the status quo before design intervention, and ‘system design’, which is the actuality which is hoped to be achieved by the process of design, and argues that there needs to be a focus on reducing this gap (Heeks 2002).

Chrishanti Avgerou warns against nurturing technological deterministic expectations that the introduction of ICTs will lead to specific socio-economic improvements. She uses the introduction of telecenters as an example. Telecenters are premises for shared access to ICTs, typically computers with internet access and printers and scanners. The reasoning behind the telecenter concept is the idea that the socio-economic condition of population in the Global South can be improved if they get access to internet as a global source of information and as a means of communication that transgress topographical hindrances. However, after an initial period of enthusiasm and great expectations for the transformative capacity of telecenters, research has showed a more nuanced picture with many examples of failure (Avgerou 2010).

In this paper I will present a story about how assumptions inherent in a telecenter concept about how it can enable people to utilize their capabilities for living productive and creative lives did not match with the priorities made by the customers, and how the introduction of a photocopy machine revealed these differing understandings of what is the appropriate way of using a telecenter to seek development.

Methodology

This paper is based on data generated by participant observation and semi-structured interviews in the Community Power pilot project, which is a joint project of the Bangladeshi mobile operator Grameenphone and University of Oslo. My data generation takes place in the Grameenphone headquarters, in the village where we are conducting the pilot, in the University of Oslo premises and in mediated
communication between these places. I lived and worked in Bangladesh from 2004 to 2006, and spent shorter periods there between 2006 and 2010 as part of my work as a researcher in the Norwegian telecom company Telenor. I understand, speak and read a fair amount of the local language Bangla, but rely on translation for interviews and extensive conversation. I have a regular field assistant who translates when I visit the village which hosts the pilot. The data is generated in the period from July 2010 to present. I have spent altogether six months in Bangladesh, and eight weeks in India visiting similar projects and interviewing practitioners to create a basis for reflection on the experiences we gain in our pilot project.

In this project I take a position as an engaged scholar (Van de Ven 2007), in the sense of aiming to contribute both to the advancement of theory and practice. My methodology is ethnographic. By means of participant observation I study the process of developing an infrastructure. Participant observation requires immersion in the field of study, but also analytical distance. Analytical distance can be achieved by physically stepping away from the activities one is studying and establishing a mental distance by writing fieldnotes that describe these activities in detail and reflect on them, and on the role the researcher has had in these activities. The epistemological stance of ethnography is interpretive, i.e. based on the view that knowledge is socially constructed. This implies that the data is generated in the interaction between the researcher and the informants (Orlikowski and Baroudi 1991).

The choice of methodology has implications for style of writing (Van Maanen 1989). When data is understood as products of situated interactions between the researcher and the informants, it becomes imperative to describe these interactions and the settings in which they take place. Moreover, inherent in an interpretative epistemology is the understanding that any text describing human actions is a product of interpretation, and that yet another layer of interpretation is added when the reader engage with the text. From this understanding arises the awareness that another story could always have been told. This means that the writer must take responsibility for the stories she chooses to write, and arguably also for the stories she chooses not to write. But it also bestowed in the writer the power to write interventionist stories that aims to inspire action (Winthereik and Verran 2012). My ambition for this paper is to inspire reflection on some issues regarding designing with the pronounced goal of facilitating socio-economic development. The question that arises is thus: What kind of story is most likely to facilitate this? How to write a story that inspires reflection on design? I am thinking that such a story should be sufficiently descriptive and detailed to stimulate associations to other stories and to cases from the reader’s own experience. This is my ambition for the following story about how the Community Power pilot project in Bangladesh was initiated, how a telecenter was included in the design and how the introduction of a photocopy machine revealed different understandings of what is the appropriate ways of seeking development by means of a telecenter.
Searching for a new concept for rural electrification

1.4 billion people in the world do not have access to electricity (OECD/IEA 2010). 96 million of them live in Bangladesh, mostly in rural areas (IEA 2011). Being connected to the national electricity grid implies frequent outages, and neither households nor industry can rely on uninterrupted access to electricity. At the same time, the mobile industry is growing in Bangladesh, as elsewhere in the Global South. As the urban markets are approaching saturation, the competition for customers is increasingly taking place in rural markets. The mobile industry has managed to build and maintain infrastructure in areas where other major infrastructures like roads and electricity are absent or dysfunctional. There are 548 million mobile subscriptions held by people living beyond electricity grids (GSMA 2010). This infrastructure expansion relies on sufficient and stable electricity access. Diesel generators are used to power mobile towers in off-grid locations, but renewable energy, in particular photovoltaic, has emerged as an economically viable alternative (GSMA 2010).

Capturing market shares depends, however, on more than available network infrastructure. When there is network coverage but scarce access to mobile charging facilities, the customers will save their batteries and use the mobile less than they would have liked to. This means that the mobile operator receive less revenue than the potential in this area. Building mobile charging facilities in connection with the network infrastructure is a way of addressing this problem.

Digital health information systems are also currently being expanded in remote areas of the Global South. The research group Global Infrastructures at the University of Oslo is heavily involved in such work, and has for a long time been grappling with the challenge of how to ensure sufficient and stable electricity supply to power servers and other necessary artifacts in remote areas (Asangansi and Braa 2010). The mutual desire to develop a sustainable model for rural electrification to support infrastructure expansion combined with a long professional relationship between two key persons brought researchers from University of Oslo and employees of the Bangladeshi mobile operator Grameenphone together in late 2009. By July 2010 the Community Power Project was launched as a partnership between University of Oslo and Grameenphone. This is a pilot project aimed at developing a financially sustainable model for a village electricity grid based on mobile infrastructure. The pilot is still going on per June 2013.

Developing a mobile based electricity grid

The starting point for developing the Community Power concept was a mobile tower powered by photovoltaic energy. The project team decided to add additional photovoltaic panels and batteries to the tower and use these to supply electricity to households in the vicinity through a grid. A challenge when designing stand-alone village electricity grids in the Global South is to arrive at a model that is economically sustainable (GSMA 2013). The investments for a solar energy mini grid include batteries, solar panels and cables. In order for the mini grid to be economically sustainable, sufficient revenue needs to be generated from the consumers and saved so
these elements can be replaced when they expire. This means that the price per kWh will have to be considerably higher than what customers of national electricity grids normally pay. At the same time, the people connected to village mini grids in the Global South generally have low purchasing power. A dilemma faced by developers of village mini grids is hence whether the electricity demands of people should be met, with the risk that the grid will be dependent on donations for sustainability, or whether the electricity access should be limited so that people are able to pay a sustainable price for what they consume. In our project, we emphasize economic sustainability, and we decided keep the capacity of the system smaller than the demand (the capacity is 3.15 kWp). 136 households and two temples were initially connected to the grid, with access to electricity from 5pm to midnight. The monthly electricity fee was set to 150 Bangladeshi Taka (approx. 2 USD). Due to the limited capacity, each household can only consume a small amount of electricity. We solved this challenge by deciding to not installing sockets, only one fixed light bulb per house. Since we decided against sockets, providing mobile charging became a challenge, and after trying out a couple of solutions, we are still working on meeting the expectations that people have for private mobile charging facilities.

Finding a pilot community

A criterion for selection of a pilot village was that it had to be located in an area that was not covered by the national electricity grid, and that was not likely to get this facility in the foreseeable future. Bangladesh is a vast river delta, and there are many landscapes where building fixed infrastructure is challenging due to the unstable soil. The haor is one of these landscapes. A haor is a vast area characterized by great seasonal changes in the water level. In the rainy season the water level is high and the haor looks like a sea with small, densely populated islands. Transport of humans, animals and goods is done by boats. As the dry season draws closer, the water recedes, muddy land emerges and the small islands grow larger until they merge with neighboring settlements. When the land is dry, a variety of motorized vehicles take over the transporting. In the in-between season, transport is particularly difficult, and whether a boat or a motorbike or a combination of the two is appropriate has to be assessed from day to day. In a village in this landscape, Grameenphone had erected a solar powered mobile tower some years earlier, and a visit was arranged to present the pilot concept to representatives of the village elite. I will call the village Haorbari. The time it takes to travel to Haorbari from the nearest small city depends on the season and the vehicles one has access to, but it is hard to manage in less than two hours, and it can take four hours or more with public transport. Most of the houses in Haorbari are made by bamboo and corrugated iron. There are no roads, and not even rickshaws, which constitute a main characteristic of the Bangladesh transport sector in urban as well as rural areas. In the rainy season, the paths become slippery with mud, and walking is a strenuous affair. There is no community clinic in Haorbari, and patients have to be transported by boat or motorized vehicles an hour or more to reach a health facility. Yet, 20,000 people live in Haorbari, and it is the commercial hub of the area due to its location by a river. There is a high school as well as a college in
the village. Because of the remote location, the cost of fuel for generators is high, and there is a strong demand for affordable electricity. After negotiating with local businessmen who supplied the commercial sector with kerosene, an agreement was made with the village elite that we could pilot the Community Power concept as a household grid.

Arriving at a model for operation

After sketching the technical configurations and finding a pilot community the next area of concern was to arrive at a viable model for operation. Basic maintenance, security and customer relations have to be assigned to someone who is present in the community. We discussed establishing a village energy committee inspired by the SCATEC Solar approach in India (Verma 2008), and considered partnering with a Non Governmental Organization with an extensive infrastructure in rural Bangladesh. These two possible models for operation were brought to the table at a workshop in the capital Dhaka in July 2010. In addition to employees of Grameenphone and University of Oslo, a handful of renewable energy experts from local universities and NGOs were present, and a representative from the village. The NGO representatives warned against the model involving a village energy committee. They said that basing the operation on a committee consisting of village members is risky, given the political environment of Bangladesh. The power balance in a village is influenced by developments in the national political arena, and the latter has been rather unstable, with two political parties alternating on being in power every few years since the early 1990s. Hence, they argued, there is a risk that a village energy committee will be associated with a specific political party, and this may erode its authority after the next election, should the government change. This discussion may have evolved differently had someone mentioned that the population of Haorbari is almost exclusively Hindu. It is well known that Hindus usually support the party Awami League, so it would be unlikely that affiliation with national party politics would define the local political divisions. But as this was not brought to the attention of any of the people who voiced their opinions, it was concluded that a village energy committee was a too risky model.

Cooperation with an NGO was considered a more viable solution. The NGO sector in Bangladesh is large and well organized. The largest national NGOs are present in all parts of the country with offices at village level. They have a large portfolio of programs, ranging from education and health to micro-finance. Partnering with a large NGO would mean that we could delegate the day-to-day operation of the electricity grid to an organization that was likely to be well connected and trusted in any village we would enroll in our pilot project. However, this idea was eventually also rejected because we assumed that the bureaucratic character of the large NGOs would imply a long period of negotiation and planning before we could start the pilot.

But as we discussed the different suggestions for how to operate the grid, a third idea was launched by one of the Grameenphone employees. Grameenphone has a telecenter concept named Community Information Center. It is operated by a franchise model, with premises in most areas of the country. However, it was not
considered feasible to establish Community Information Centers in remote areas because of the scarce access to electricity. The Community Power Project, he argued, represented an opportunity for rolling out Community Information Centers to previously unreachable areas. Moreover, it also represented a viable model for day-to-day operation of the Community Power electricity grid. The Community Information Center franchisee will take on the responsibility for the operation in exchange for a percentage of the collected electricity fees. The combination of telecenter business and grid operation is likely to generate a decent livelihood for a family, he explained. This idea was well received, and the Grameenphone Community Information concept became an integral part of the Community Power design. Through this, the ICTD element of the project became more pronounced.

Establishing a Community Information Center in Haorbari

The Grameenphone Community Information Center (CIC) is a premise where people can access ICT-based services. In the Grameenphone webpage it is stated that the CIC concept is funded on a wish to serve local communities by bridging the digital divide by providing information access to rural people and alleviating poverty through this. Moreover, the objective is to educate the underserved and underprivileged, building local entrepreneurship and capacity and create employment opportunities for unemployed youth (http://grameenphone.com/about-us/corporate-information/social-initiatives/community-information-center). All Grameenphone Community Information Centers (CICs) are equipped with the minimum of a computer, a printer, a scanner, a webcam and an EDGE-enabled modem. Services offered are internet browsing and e-mailing, chatting, video conferencing, scanning, printing, access to e-government services, etc. Some CICs are also equipped to offer telemedicine services. In addition, all CICs offer basic mobile services such as sale of SIM-cards and call credit (http://grameenphone.com/sites/default/files/sitecontents/CIC%20Model.pdf).

Prospective candidates among the businessmen in the market were interviewed for the position as a CIC entrepreneur, and a man in his early thirties was selected. All CIC entrepreneurs attend a training session when they are appointed. The training include information about basic operation of a computer (such as how to turn it on and off) as well as how to set up the EDGE Modem and what kind of information and services can be availed via the Internet. The entrepreneurs are also trained in customer relations and basic marketing. They are encouraged to tailor the service portfolio according to local demand. In a semi-rural area where computer literacy is fairly high due to higher education levels and more exposure to ICTs, it may be a good strategy to focus on services like e-mailing and social networks, while assisted access to government web pages may be a main service in a remote community where computer literacy is low.

Entrepreneurship and adaption to local demands was emphasized in the training of the Haorbari entrepreneur, whom I will call Biduvt. I attended this training session, which was held in the Grameenphone district office in the closest city. The Grameenphone employee who conducted the training (I will call him Naveed), explained the concept of entrepreneurship to Biduvt with the following story:
Two men were sent by their boss to sell shoes in a market far away. When they arrived, they noticed that nobody wore shoes there. One of the men went back to his boss and said: “This is impossible, I can’t sell shoes in a place where nobody wear shoes!” The other main said to himself: “This is a fantastic opportunity! Here everyone will need shoes!”

Naveed added that “this is business mentality, this is how you need to start thinking!” In the lunch break afterwards I asked Naveed to elaborate on this. He said that it is important for the CIC entrepreneurs to understand what entrepreneurship is, otherwise they will act as traditional shopkeepers who just comes to the shop in the morning and sits there the whole day without taking any initiative to create business opportunities. In this case the CIC will not create a surplus and will eventually be shut down. An entrepreneur is someone who uses his own capability to make business, it is someone who innovates, he said.

With this advice about how to develop a prosperous business, Biduvt traveled back to Haorbari and transformed his store into a CIC. He used to sell hygiene products and cosmetics. Such products are still found on the shelves, but the store is now easily distinguishable from the other shops in the market by its Grameenphone sign and its white wall coverings decorated with Grameenphone posters. The store consists of a long and narrow room with a smaller back room where customers enter only on invitation to discuss matters that require privacy, or as we will later see, have their photo taken. A long desk dominates the front room. The main business; sale of airtime and recently also mobile banking services, are taking place close to the entrance. At the back end of the desk, the CIC equipment is set up. There is a desktop computer, a laptop computer, a printer and a scanner. To use the computer, one needs to open a little gate and enter the inside of the desk. This set up indicates that it is the employees who mostly operate the computer. During my first visits to Haorbari in the fall of 2010, I noticed that this was indeed the case. I observed several customer sessions, and in none of them did the customers touch the keyboard. In 2010, the computer in the Haorbari CIC was predominantly used for selling mobile content. The sessions started with the staff inserting the memory card of the customer’s handset into a memory card reader, plugging it into the computer and erasing the films and music already there. Then he played snippets of music and films that the customers could choose from. Occasionally the customers appeared to be requesting certain artists, songs or films, but the staff also seemed to a large extent to be choosing which content to play. Every now and then the customer signaled that he wanted to buy that song or film. The sessions I observed were fairly lengthy, lasting up to half an hour. The customers looked at the screen from time to time, some appearing to be eagerly watching how the staff handled the equipment and others appearing to be interested in watching the film snippets only. When I inquired about the practicalities of the mobile content vending, I got to know that the process of establishing and updating a content library in the Haorbari CIC did not involve downloading from the internet. The content was bought from content vendors in the nearest town, stored in USB sticks and memory cards and brought by a means of bus and boats, trucks or motorbikes, depending on the season, to Haorbari, where it was transferred to the desktop computer in the CIC. There were a number of other stores in the Haorbari market that also were equipped with computers, and they also used them to sell mobile content.
None of these stores used the internet for downloading, or offered internet based services.

**Catering to local demands**

When I came back for a short visit in 2011, and on several visits during the winter of 2012, I was curious to see whether the Haorbari population had started to come to the CIC to use internet, whether in person or with assistance from the entrepreneur or his assistant. I found, through observation and conversations with the entrepreneur, villagers and staff of the local college that there were some internet use, but still very limited. When customers wanted to access internet, they mainly wanted to access government sites. The publishing of the public school exam schedule, as well as the exam results, caused a peak in the demand of internet services. Another peak was connected to the announcing of available positions in the bureaucracy. Apart from that, there was the occasional customer who wanted to use e-mail or read online news. The entrepreneur chose to not charge for browsing, only for printouts. If browsing picks up among his customers, he will consider introducing a fee.

At the same time, the mobile content vending that was the main use of the computer in 2010 had now receded. The entrepreneur told me that he no longer encouraged this, as it had turned out to be very time-consuming in relation to the profit earned. Instead, he had decided to emphasize photo services. At the inauguration of the Community Power Project, Grameenphone gave him a digital camera as a gift. He dressed a corner of the backroom of his shop with white cloth to make a photo studio, and taught himself how to use Adobe Photoshop. This turned out to be a very popular service. Many people in Haorbari are micro-credit customers, and to enter a relationship with a credit institution, they need to submit an ID-photo. Participation in government work programs for people below the poverty line also require a photo ID, and this is also needed for enrollment in the local high school and college. Other customers came to have commemorative photos taken. The customers appreciated the newly acquired Photoshop skills of the CIC entrepreneur. Many photos were taken with the mundane background of the back alley of the CIC and in Photoshop changed into portraits of children in lush gardens, a family sitting in a fluffy, white sofa with a broad, winding staircase in the background, or a young man leaning against a shiny sports car. They were printed on photo paper and laminated so they would last long hanging on the bamboo walls of their homes in the humidity of the rainy season.

Other highly appreciated features of the CIC turned out to be its scanning and printing facilities. Interaction with non-governmental organizations (NGOs) and government institutions sometimes require a photocopy of ID papers. NGO workers needed to duplicate documents, and the high school and college also occasionally needed copies of documents. However, when a large number of copies are needed, using a scanner and printer is time-consuming. It is also troublesome to scan the large account books used in Bangladesh with a scanner that can only scan a part of the page at a time. A photocopy machine is much more suited for the mass copying demands of the NGOs and schools, and Biduyt decided that this would be a wise investment.
But by catering to this community demand, he instigated a threat to the sustainability of the Community Power system that the CIC is a part of.

**The ambiguous photocopy machine**

The photocopy machine was a very welcome addition to the equipment in the CIC. The nearest photocopy machine is located in a market that in the summer can be reached by 1-2 hours of boat-journey, and in the winter by either 1-2 hours on a local truck or by 20 minutes and a considerable amount of money with motorbike. The NGO workers and teachers were happy to not have to spend so much time and money when they needed to get something copied. The photocopy machine maintained a harmonious relationship with the rest of the Community Power system until one day in the last month of spring. It rarely rains during winter and spring in Bangladesh, but in the summer season there is occasional heavy rain before the rainy season sets in. On this day, it rained heavily from the morning till late afternoon, and in the evening the lights failed to turn on in the households. An electrician was called, and he reported that the outage was caused by over-consumption of electricity in the CIC. He identified the photocopy machine as the culprit. During the dry season there had been enough sunshine for the solar panels to produce sufficient electricity to run all these devices during daytime as well as to fill the batteries sufficiently for the households to get electricity at night. But as the rain started, the solar panels did no longer manage to produce enough electricity to cater for the daytime over-consumption that had developed during the dry season as well as the needs of the household grid. The introduction of the photocopy machine increased the CIC’s relevance for the community, but turned out to be in conflict with the design of the Community Power system that the CIC is a part of. Biduyt was informed that he had to stop connecting the photocopy machine to the solar grid, and he reluctantly disconnected it.

However, the photocopy machine continues almost one year later to be a source of controversy. In January 2013, Biduyt, my field assistant and I were sitting in the backroom of the CIC discussing the status of the Community Power project when two young women entered asking to use the photocopy machine. Biduyt answered that is was broken, and they left. I later asked Biduyt whether I had understood what he said, was the photocopy machine broken? He explained that it is not actually broken, but that he had said so because he cannot use it anyway because he is not allowed connecting it to the Community Power grid. Using a diesel generator to power it would be so expensive that offering photocopying as a service would be a loss rather than profit. But, as I could see, the people in Haorbari really appreciated the photocopy machine, he said. “Would it not be possible to arrive at a compromise?” he asked me. He suggested that he commits to only allowing photocopying to be done a couple of hours per day, and that he keeps it off entirely on rainy days. This way it will be possible to at least partly cater to the needs of the community without jeopardizing the viability of the electricity grid. I imagined a high school teacher spending his time with the pupils rather than on a boat on the way to photocopy the exam register, worrying about reaching back in time before sunset and worrying about the stories of boat robberies that he heard in the tea-stall the day before. I shared
Biduyt’s desire to find a feasible compromise, and said that he should discuss his suggestion with the electrical engineers in the project next time they come. But when the engineers came to the village a couple of weeks later, they concluded that even limited use of the photocopy machine is incompatible with the capacity of the electricity system. The issue is settled for now, but the photocopy machine, now covered by a towel, keeps reminding Biduyt and his customers of a service that can no longer be availed.

By purchasing the photocopy machine, Biduyt followed the entrepreneurial ideal that was advocated in the training session. Yet his innovation turned out to threaten the feasible of the overall system. The photocopy machine plays an ambiguous role in this story because it is a successful system innovation seen from the perspective of the CIC entrepreneur and the community members, but does at the same time represent a threat to the viability of the Community Power system that it is a part of. The introduction of the photocopy machine revealed two contradictory understandings of what a CIC is. From the perspective of the stakeholders from Grameenphone and University of Oslo, the central attribute of this assemblage of computer, printer, scanner and mobile charging booth is its capacity for accessing the Internet. The CIC is understood as an internet café that offers a portfolio of additional services, such as duplication of documents. For the CIC entrepreneur and his customers, the central attribute of this assemblage developed from the capacity to transfer digital content to mobile phones to the capacity to print photos and duplicate documents. Realizing this, the entrepreneur accentuated this attribute by adding a photocopy machine to the assemblage. Seen from the perspective of the stakeholders in Haorbari, the CIC has emerged as a photo studio and photocopy center.

Both sets of stakeholders recognize the development capacity of the CIC, in the sense of providing access to tools individuals can use to utilize their capabilities for living productive and creative lives (Seen 1985). But our ideas about what is an appropriate way of using this assemblage to seek development differ. The photocopy machine made this difference visible, and by claiming a large share of the overall capacity of the system, made sure that we could not ignore it.

Some reflections on designing for development

Chrishanti Avgerou voices the concern that there is not enough reflection on the concept ‘development’ in ICTD projects (Avgerou 2010). Walsham and Sahay (2006) also address this, and suggest that every research project on ICT provision in developing countries should address the question “What is the development to which ICTs aim to contribute?” This is a sound advice for practitioners as well. The story about the Haorbari CIC suggests that reflecting on the term ICT can be a good starting point. When the term ICT is used to denote the assemblage of artifacts that commonly constitutes a telecenter, it is likely that its capacity for supporting information processing and communication will is emphasized in design. In this way, the term ICT can conceal capacities that may be prioritized by the users. Occasionally letting go of the term ICT as a conceptual guide to understanding the assemblage of computer, scanner and printer, may be a way of generating alternative use scenarios.
The demands of the customers to Haorbari CIC are related to characteristics of Haorbari as a place. Walking around in the market by the riverside, one can find several stores that make a business with a computer, but none of them offer internet access as a service. The experience that most Haorbari people have with computers is hence as artifacts for playing and vending music and films, and for transferring and printing photos, and with this experience they encountered the Haorbari CIC. The landscape of Haorbari also influenced which services came to be in most demand by the customers. At the first encounter, the remoteness of Haorbari is striking for a visitor accustomed to abundant transport infrastructure. But after spending some time there, the perception of Haorbari as periphery alternate with the perception of Haorbari as a center. A sizeable bureaucracy within the education sector, NGO sector and government sector is serving the population of approximately 20,000 inhabitants. There is a vibrant fish trade sector, and many people pass through Haorbari. This mix of remoteness related to the limited possibilities for effective and affordable transport of people and centrality related to a large population, accentuates the need for services supporting bureaucratic functions, such as photocopying and production of ID-photos. Taking the local context into consideration when designing ICTD projects, is an established approach (Avgerou 2010), and the story of the Haorbari CIC suggests that assessing the availability and condition of existing information and communication infrastructure, both digital and physical, will indicate what kind of services the prospective telecenter customers will demand.

The story about the Haorbari CIC also invites reflections on the relation between design and use, and how and where design should take place. Richard Heek’s concept design-actuality gap may shed light on how the use of the use of the CIC did not match the expectations of the pilot team members (Heeks 2002). A gap can be seen between the local actuality of experience with computers as content vending artifacts and a considerable bureaucracy combined with badly functional transport infrastructure on one hand, and the actuality of internet use as a main service that is the imagined outcome of the telecenter design on the other hand. But Grameenphone’s CIC concept has a considerable amount of flexibility. It does acknowledge that there are a great variety of communities in Bangladesh, and that different telecenter services will be in demand in different places. Biduwt was encouraged to explore the needs of his community and adjust his service portfolio to this. Implicit in Heek’s design-actuality gap is the idea that design aims to get us somewhere in particular. Margunn Aanestad advocates a processual view on design. She has studied how a telemedicine infrastructure in surgery evolved as an interrelationship between existing work practices and a new technology. She arrives at an understanding of design as ‘design of configurations’, by which she means a mix of people, practices and artifacts. She argues that in the case of designing technologies meant to be generic or open, the discovery of well-working configurations can be the core of the design process (Aanestad 2003). The telecenter concept implies a high degree of genericity and openness, and adopting design of configurations as a guiding metaphor may be a particularly useful for design of telecenters.
Summary

The discourse of Information and Communication Technology for Development (ICTD) is based on the premise that ICTs can be suitable tools for attaining development. However, it has been argued that there is a lack of reflection about what kind of development is envisioned in the ICTD discourse (Avgerou 2010, Walsham and Sahay 2006). In this paper I have attempted to stimulate reflection on design of ICTD initiatives by telling the story of the Community Power pilot project in Bangladesh. I have emphasized how focusing on capacities for information processing and communication can conceal capacities that may be considered more relevant for the prospective users in their development efforts. Off-web attributes, such as scanning and printing functionalities, may be more valued than on-web attributes such as access to e-mail, internet search and chatting services. I have suggested that assessing the availability and condition of existing information and communication infrastructure, both digital and physical, is a good design strategy. Lastly, I have proposed that Margunn Aanestad’s design metaphor ‘design of configurations’ (2003) may be particularly useful for designing telecenters.

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An Activity Theory Lens on Digital Preservation: Challenges of Using Preservation Services

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Abstract. Digital preservation provided as a service introduces new challenges for organizations with a preservation need. Implementing this digital preservation service based on cloud-based sub-services introduces challenges for service providers. This paper uses Activity Theory to discuss the inherent difference in concerns between activity systems representing the production of information, consumption of information, and preservation of information. These differences in concerns have been studied in the ENSU RE project where three use case owners provided empirical data on the organizational motives, and the service provider side were represented by those designing the system, including ourselves. Using Activity Theory, various contradictions within and among the identified activity systems pertaining to digital preservation are described. Specifically, problems related to communication deficiencies between the organization and the service provider is analyzed in light of the interventions in ENSURE and a partial solution is identified. This is research in progress.

Keywords: long-term digital preservation, activity theory, information quality, cloud-based services, boundary objects, communication deficiencies, ENSURE.

1 Introduction

Long-term digital preservation is a means to an end – enabling future access to digital information in anticipation of technological and social change. We are studying long-term digital preservation in an organizational context, where an information creating organization in anticipation of future use is utilizing an external preservation service to realize the preservation – a service that is governed by mutual agreements, e.g. on cost, service level, and access control.

The ENSURE project (an Integrated Project within the FP7 programme) [2] aims at providing a technology platform for preservation service providers based on preservation sub-services provided by third parties. These sub-services cover functions such as storage and computations, including diversity configurations of such functions. An ensemble of these functions will, governed by a preservation plan and
under the choreography of the ENSURE runtime, address an organization’s needs for long-term digital preservation. Among the novel approaches taken in ENSURE (and relevant for the discussion) is a software artifact provided to the client organization for making decisions on a preservation plan, based on calculations of costs and assessments of economic performance as well as quality.

ENSURE provides a graphical user interface (GUI) to the client organization that is used to capture requirements regarding business value and this information is fed into a configuration engine that, given a set of rules, create a set of proposed preservation plans. This set of proposed preservation plans is fed to evaluation engines that calculate the cost, the economic performance, and an assessment of the quality of the proposed plans. An optimizing step then identifies a subset of the proposed plans that are then presented to the client together with various metrics that empowers the client to make a final decision on preservation plan. The preservation plan is then fed to the preservation runtime, which instantiates a preservation system according to the preservation plan.

Interviews with the ENSURE project use case owners [3] reveals a communication deficiency at the organizational border between the producer of information and the provider of preservation services. Internal to the preservation service, the digital preservation activities in terms of services and sub-services constitute a specialization of concerns that is hard to translate to the outside observer. At the same time the preservation service provider is struggling with understanding the information consumer needs in order to match those needs in the preservation process. The intervention provided by ENSURE, to let the client make the final decision of preservation plan, is constrained by the translation problem where the client struggles to discern the consequences in business terms of making any specific decision on preservation plan.

From a socio-technical viewpoint, we see the need to address these communication deficiencies as they affect the success of procuring preservation services outside of an organization in general and the success of sharing efforts of digital preservation by means of cloud-based services in particular. Our research question concerns these communication deficiencies and how the information producer and information preservation service provider can come to an agreement on a plan for digital preservation. This paper is a problem description and formulation, based on case studies in the ENSURE project.

We need a framework in which we can discuss the problems with communication and differing concerns. A literature review around these issues showed no prior art related to digital preservation. We will use activity theory [4] as a descriptive tool to describe and analyze the preservation activities, but we acknowledge that this is not the primary intention of activity theory. We note that others have used activity theory as a descriptive tool [16].

Third generation activity theory, as set forth by Yrjö Engeström [5], describes interconnected and cooperating activity systems, which lends itself to analysis of contradictions and strains within and between these activity systems. We have identified three activity systems: one covering the information producing organization, one covering the digital preservation service provider, and one covering
the information consuming organization. We will refer to these three activity systems and re-state the problem of long-term digital preservation in terms of two activity systems interacting in order to estimate the need of the third activity system.

2 Background and related work

![Figure 1. The OAIS Functional Entities](image)

The Open Archival Information System (OAIS) provides the classical conceptual model of a preservation system [6], see figure 1. OAIS gives a functional view of digital preservation as seen from within the preservation system itself and identifies the producer and the consumer as actors interoperating with the preservation system. The characteristics of this interoperation are subject to mutual agreements among the stakeholders, e.g. on the producer side governing structure and format regarding the information input to the preservation system, and on the consumer side governing access control and anonymity of information accessed in the system. OAIS does not demand that the system border equate the organizational border.

![Figure 2. Thibodeaux's view of the digital object](image)

Long-term digital preservation represents a field of practice that comprises understanding of the effects that technological and social change have on information.
Thibodeau [7] and Rothenberg [8] discusses this from a strategic viewpoint where they focus on the digital object, i.e. the information to be preserved, and describe different strategies for preservation such as emulation (of hardware or software) and migration (of data formats). Thibodeau discriminates among different aspects (layers) of a digital object: as a physical object, as a logical object and as a conceptual object (see figure 2).

![Figure 3. The Performance Model.](image)

The performance model [9] describes the effect of digital preservation from a perceptual viewpoint (see figure 3) where the concept of performance matches the conceptual object of Thibodeau. Using a definition of (information) quality as fitness for a specific use [11], the performance model states that quality has to be understood in the context of use as the perceived quality of the performance – i.e. the perceived quality of preserved information in a specific use context.

If no effects of technological or social change were present, basic data storage would suffice for providing future access to information – even in the long term.

![Figure 3. No effects of technological and social change are in effect.](image)

In reality the presence of technological and social change forces the preservation process to accommodate for these effects.

![Figure 4. The individual forces of change and their resulting effect.](image)

In the case of technological change, say the demise of a popular file format, the preservation process could either choose to migrate data to the new state T_2 or emulate the original state T_1 by providing specific software. In the case of social
change, say the public understanding of an ontology, the preservation process could either choose to translate data to the new state $S_2$ or provide representational information that accommodates for future access to data in its original state $S_1$. In terms of Thibodeau, the physical and logical object levels capture technological change while the conceptual object level captures social change.

The perceived quality of future access to information in this system would be defined in terms of how usable the information is in that future context. The problem in long-term digital preservation is that we have to make á priori assumptions about the future perceived quality and choose a preservation plan to realize that future – in anticipation of unforeseen technological and social changes. The effects of technological and social change have to be understood in the context of future use of the preserved information.

There are aspects of this perceived quality that transcends the digital object itself, e.g. components of trust or lack of trust in the preservation service, which influences the future usability of the preserved information. An example could be future use of preserved information as evidence in a court case where admissibility may be questioned [10].

In ENSURE, we try to assess the quality of the proposed preservation plans in light of technological and social change in general and in utilizing sub-services provided by sub-providers in particular. In order to understand the influence of interobjective factors on the perceived quality, we refer to the Trustworthy Digital Repository specification, TDR [1]. Quite a few interobjective factors related to trust are covered in the TDR specification, where issues such as staff turnover and economic viability of the service provider are addressed in order to arrive at a conclusion of trustworthiness. TDR contextualizes the functional requirements of OAIS in a preservation service provider setting, but it does not do so in terms of established information quality concepts.

Wang and Strong [11], identified a number of quality dimensions that later have been contextualized in a number of fields [12][18][23][24], even digital preservation [13]. Neither of these addresses perceived intersubjective quality factors emanating from a specific choice of preservation service provider or preservation strategy.

What is lacking is a treatise that specifically addresses how the motives of the individual stakeholders regarding preservation influence the perceived quality of a preservation service in general and preserved information in particular. Preservation of information is a socially constructed system that addresses an end involving human beings preparing, preserving, and making use of information – systematic activities taking place in organizations consisting of human beings organized around a common goal. We are looking to activity theory in the setting of Yrjö Engeström [4][14][15][16], which has its roots in organizational studies; to analyze how organizational motives affects the efficiency of the preservation process. There is no existing treatise on this aspect of the digital preservation problem and we are addressing this gap.
3 Method

Our research is conducted within the ENSURE project, where we follow an abductive approach to action research. Three use case owners from the healthcare and financial sectors, for which a series of artifacts for long-term digital preservation are developed and tested, provide the case at hand. We are participating in the capturing of requirements, the development of software for the ENSURE platform, and the validation of the platform according to the established use cases [17]. Additionally, we have conducted interviews with the use case owners [3], i.e. the information producers as well as consumers.

These interviews are an important part of the empirical experience, but the problem definition and our understanding has also emerged during participation in the project, from communication with the use case owners and the project partners, from contributing to deliverables from the project and participating in reviews. This empirical information is being assembled.

The interviews were conducted during November and December 2012. They were semi-structured, following an interview guide that was sent to the persons in advance. The informants were given opportunity to speak freely and the questions were adapted to what was said. The questions covered details of information production and consumption. Additionally we asked questions related to the preservation of information, which mainly follows the structure of TDR; organizational infrastructure, digital object management, and infrastructure and security risk management. The interviews were documented both in writing [3] as well as recorded.

3.1 Activity theory as a descriptive tool

Engeström posits the activity as the minimal unit of analysis (see figure 4). The general model of activity, which according to Engeström should not be decomposed or reduced to its individual parts, require some explanation that by necessity has to be presented in parts.
• The subject is an individual or a group of individuals participating in a role within the organization according to organizational motives through action (as an individual) or activity (as a group). An example could be the role of producer (in the OAIS meaning) interacting with a preservation system on behalf of the organization.

• The activity in question is directed towards an (mutable) object in order to achieve a desired outcome. An example could be how we treat information as an object where the outcome of preserving the information would be successfully preserved information – even though we can discuss from which viewpoint the success is assessed.

• The instruments mediates in this activity and may be viewed as the means needed in order to achieve the desired outcome; e.g. software artifacts (such as the preservation services framework developed in ENSURE), theories, concepts, etc.

• The community could be viewed as consisting of all individuals of the organization, individuals that share common concerns and to some extent share the same language (concepts, ideas and discourse) and social understanding.

• The rules are defined by the community and govern the activity of the subject – it mediates between the community, representing the social context of the organization, and the role that the subject takes on. These are the rules that the subject should adhere to in conducting its role. Example of rules could be economic, i.e. that the subject should contribute to the overall profit of the organization by minimizing cost and maximizing income, or legal, i.e. that the subject must take into account the legal obligations of the organization (such as preserving financial information for a given period of years as required by the government).

• With division of labor is meant task specialization by individuals or groups within the organization. It can be used to visualize power relations within the organization as it “mediates” between the community and the object by identifying those being engaged in achieving the outcome.

The activity triangle can be decomposed into four higher order functions defined by the “production” sub-triangle (Subject-Instruments-Object), the “consumption” sub-triangle (Community-Subject-Object), the “exchange” sub-triangle (Community-Rules-Subject), and the “distribution” sub-triangle (Community-Division of labor-Object). According to Engeström, these higher order functions within the activity system gives rise to tensions that forces the evolution of motive of all activity systems.

In order to illustrate the nature of these tensions, consider an organization that operates internally on information where production of information demands consumption of information, which has to be counterweighted by the fact that in order to consume information we have to produce information. Transferred to a digital preservation setting where we are addressing the memory function of organizations, the organization will only be able to operate if it has a working organizational memory.
These tensions gives rise to a series of contradictions within the activity system (of the organization), between activity systems and between emerged versions of the same activity system. In light of digital preservation, the latter could be exemplified by two versions of the same organization separated in time – the passing of time being the most prominent feature of any preservation undertaking!

The rise of a need within the organization; by Engeström referred to as a “need state” and something that he deems inevitable, forces change. Engeström argues that through activity the context (of the organization) is continuously emerging, i.e. the organizational context will evolve over time and the concerns of the organization will change as well. In a preservation context this is an argument for the fundamental problem of planning for the future reuse of preserved information, as the later configuration of the organization will have evolved and may have other needs than was planned for initially.

Engeström describes four levels of contradictions [4]:

- **Primary contradictions** within nodes of the activity (Subject-to-Subject, Community-to-Community, etc.) Only this kind of contradiction gives rise to need states.
- **Secondary contradictions** among the nodes of the activity (Subject-to-Rules, Subject-to-Community, Rules-to-Object, etc.)
- **Tertiary contradictions** between two versions of the same activity (typically separated in time as may be the case in a preservation context) where the later is an emerged version of the former.
- **Quaternary contradictions** between an activity and interacting activities.

We find this model to accurately describe the situation that we see in ENSURE and we will elaborate on the similarities. For reasons of the following discussion, we will contextualize Engeström’s activity theory using three activity systems; one representing the use case owners in ENSURE (denoted the information production activity system, see figure 5), one representing the use case owners in ENSURE in a more evolved state after time has passed (denoted the information consumption activity system, see figure 6), and one representing the ENSURE system and the organization providing preservation services using the ENSURE framework (denoted the information preservation activity system, see figure 7).

![Figure 5. The information production activity system.](image)
The information production activity system represents an organization with motives and concerns that involves producing and consuming information; this could be agreements around capital management or events emanating from doing investments, this could be information from medical encounters or medical images related to cancer biopsies, this could be information collected during a clinical test of a new medical substance.

The community typically consists of the employees (and employers) of the organization. The rules covers economic conduct, legal requirements and obligations towards the organization and the society at large. The division of labor covers special tasks demanding involvement of employees in reaching the outcome; successfully preserved information, such as archivists, IT-staff, the chief information officer (CIO), etc. As subject, we choose the role responsible for procurement of preservation services in general and the individual responsible for providing requirements to ENSURE and making the final decision of preservation plans in particular. The subject is responsible for defining the purpose of the preservation. We denote this role *producer* since this makes most sense in an OAIS context. The object may be viewed as information in the fullest extent possible. The instrument is, in short, ENSURE – the ingest part of the preservation service provided by ENSURE together with the staff operating the service.

Figure 6. The information consumption activity system.

The information consumption activity system represents the same organization as presented above, but separated in time and more evolved – where we assume that the motives and the concerns of the organization may have evolved as well.

The community and division of labor are considered to be the same as before. The rules may have changed as an effect of the evolution of the organization. As subject, we choose the role responsible for interacting with the preservation service. We denote this role *consumer* since this makes most sense in an OAIS context. The object may still be viewed as information, but now we have a pronounced need regarding the use of the information – we have a purpose for the use of the information that may from the initial purpose of preserving the information. The instrument is still ENSURE – the access part of the preservation service provided by ENSURE together with the staff operating the service.
The information preservation activity system represents activities in an organization with motives and concerns that involves providing a profitable service and having satisfied clients. The organization develops and maintains software, monitors the designated community (i.e. the information consumption activity system as time passes by), monitors technology and format obsolescence, etc. In short, it acts according to the responsibilities described among the OAIS functional entities, but with an explicit requirement of making profit from these operations.

The community typically consists of the employees (and employers) of the organization, but also sub-contractors. The rules covers economic conduct, legal requirements and obligations towards the organization and the society at large. The division of labor covers special tasks demanding involvement of employees in reaching the outcome; successfully preserved information, such as developers, IT-staff, sales representatives, etc., but also sub-contractors participating in the operations. The latter is extremely important since the configuration of the preservation service involves cloud-based services such as storage and computations that are effectively commissioned to sub-contractors. As subject, we choose the role responsible for establishing agreements with the client (i.e. the information production activity system). The object is the preservation service provided by the organization. The instrument covers development methodologies and development tools, the IT-infrastructure, legal counseling, and risk management tools (such as DRAMBORA [19]).

4 Results

The ENSURE project addresses preservation needs within the healthcare and the financial sectors. Three use case owners represent these sectors in the project and we are drawing empirical data from interviews with the use case owners regarding the information production and consumption activity systems [3]. From the participation in the development of the ENSURE platform, we are drawing empirical data regarding the information preservation activity system and the interaction of the three different activity systems that is our unit of study.
The first impressions when conducting the interviews with the use case organizations (the information producers and in the future also information consumers) are that overall the informants had problems understanding many of the preservation specific questions – mostly because their proficiencies lies in other fields. Another important observation is that the informants do not use the word preservation – instead they talk about storage. This difference in discourse seems natural, considering the concerns they have in their daily business, but is indicative of their separate fields of practice.

A key finding is thus the perceived communication deficiency between the information production and preservation activity systems, which to a large part is caused by translation problems between the concerns of these activity systems – they are not “speaking the same language”. Digital preservation represents an area of expertise that is not easily transparent to outside observers and even more so when the architecture of the overall service is composed of distributed cloud-based subservices. The language barrier between these activity systems represents a major problem.

At the same time, a preservation system cannot be viewed solely as a black-box system since there has to be a mutual understanding between the provider of the service and the producer (in OAIS terms) – the client of the service regarding the preservation plan. The preservation plan incorporates the preservation strategy and a number of choices affect the quality of the preservation service – as measured by usability of preserved information by the consumer (in OAIS terms). Therefore, the client has to take an active part in determining the preservation plan. The efficient exchange of information between the information production and preservation activity systems is key to the success of the preservation process.

We have observed that “hard facts” such as economic cost is easy to understand, as it resonates well with the concerns of the information production activity system. Risks that are possible to quantify may be incorporated into the economic performance calculation, which gives a monetary valuation of the risk, and are therefore also translatable to the information production activity system.

The qualitative characteristic of quality does not lend itself easily to a quantifiable monetary language, and it represents a real translation problem between the information production and preservation activity systems. At the same time, these quality aspects may represent success or failure of the preservation process as it is a key evaluation mechanism that tries to bridge the gap between the information production and consumption activity systems – thus giving the producer information about the possible success of the preservation process, where success is seen as providing usable information to the information consumption activity system.

The result of the quality assessments consists of a quantitative part, which is used by the optimization, and a qualitative part as a set of statements around consequences of picking any specific preservation plan. These statements represent a part of our intervention and are expressed in terms of (information) quality dimensions with the ambition of being understandable within the business concerns of the information production activity system.

We have come to understand that the problem with successful preservation of information transcends our initial findings around communication deficiencies.
between the stakeholders and have to be studied in terms of the motives that drive the
individual activity systems – problems emanating from their individual and differing
concerns. Only when the motives are clear to us may we get an understanding of
where communication fails and why.

5 Analysis

In terms of Tibodeau’s layering of the digital object, it seems that the information
producer is best suited to address problems related to preserving the conceptual
object, i.e. those part that is related to the (social) meaning of the information. The
assumption taken here is that a thorough understanding of the current use of the
information makes the extrapolation into future use easier – but this assumes an
awareness of the effects of social change; even that these changes are occurring.
Based on our empirical data, the lack of understanding of the effects of social change
within their organizations over time threatens their ability to take this responsibility.

The preservation service provider, being responsible for the preservation system
and as specified by OAIS being responsible for monitoring technological change,
only to some extent seem to be able to take responsibility for adapting to social
change. OAIS does refer to the monitoring of a designated community (i.e. some
aspects of the information consumption activity system) but in a rudimentary way.
The preservation service provider therefor seems best fit to address problems related
to preserving the physical and logical object.

Recognizing the joint responsibility for preservation of the complete digital
object, the lack of understanding between the information production activity system
and the information preservation activity system threatens the success of the
preservation process.

6 Discussion

We have constrained our research to long-term digital preservation in an
organizational context, where preservation services are procured from an external
service provider. This gives rise to some specific problems.

The first problem is related to the separation of concerns between the producer
and the consumer (in OAIS terms), see figure 8.
Figure 8. The information production and consumption activity systems.

Observe that the consumer and the producer could be different organizations or they could be the same organization; in fact the latter is the case in the ENSURE setting, where they are separated in time. In both cases the two activity systems must be considered separately since the motivation for preserving information may differ radically from the motivation for using information.

Inherently, the rules by which the information production activity system operates and by which the producer makes decisions on preservation plan – and thus on the composition of cloud-based subservices interacting in preserving the information – is restrained or governed by economy. This is a secondary contradiction between the rules and the information. The information production activity system is responsible for the choice of preservation plan and the best plan in terms of perceived quality in the information consumption activity system is typically in conflict with the cost of implementing that preservation plan – a cost charged to the information production activity system.

Thus we have a fundamental conflict in concerns between these two interacting activity systems. If the information production and consumption activity systems are really the same organization, we thus have a tertiary contradiction within the organization where the organization in the role of producer has to make responsible choices of preservation plans but also need to accommodate for future use of the information (at some later time). In this scenario there is also a primary contradiction related to the view of information where the organization in the role of the producer has to predict the usability of the preserved information. Our intervention in ENSURE aims at making these usability predictions visible to the information production activity system – using quality assessments as the tool to make this prediction for the decision maker (the producer subject).

If the information production and consumption activity systems are not the same organization, the difference in concerns becomes even larger and readily motivates the use of digital preservation methodology to capture essential characteristics of the original information for the future. There are fundamental choices made by the information production activity system when selecting a preservation plan that has
implications on the usability for individual information consumption activity systems. Take for example the mutually exclusive choices of preservation strategy: emulation or migration, where you could argue that the information is preserved in both cases but where the question of authenticity is stretched to its limit in the latter. Our intervention in ENSURE aims at making some of these fundamental qualities visible to the decision maker by categorizing the information by the purpose of preservation and evaluate the quality metrics with regard to this purpose.

The second problem is related to the separation of concerns between the information production system and the information preservation activity system, see figure 9. When the preservation service is procured outside of the organization, fundamental differences in concerns between the information production activity system and the information preservation activity system becomes significant. We have a secondary contradiction within the information preservation activity system related to maintaining a profitable operation and at the same time having satisfied clients. The rules by which the information preservation activity system has to operate covers among other things economic viability and legal obligations governed by mutual agreements between the information production activity system and the information preservation activity system.

We also have a quaternary contradiction between the information production activity system and the information preservation activity system related to the language used within each community. One reason for separating concerns and procuring preservation services outside of the organization emanates from the desire to focus on the core business. At the same time this potentially forces a wedge in between the business process within the information production activity system and the staff operating the preservation service, which is in need of understanding the business aspects of the use of the information in order to cooperatively predict a suitable preservation plan that shall accommodate use of the preserved information in an information consumption activity system.
Figure 9. The three interacting activity systems.

Long-term digital preservation represents a field of practice that according to our findings is not known to the client of the preservation service. At the same time we are asking the client to make a decision of preservation plan. How can we be sure that these decisions are made from an informed standpoint? ENSURE shows that it is feasible to translate qualitative information regarding suitability of proposed preservation plans into a representation that is easier to understand. By focusing on representing risks in terms of a monetary language, the translation to the client business domain seems to become easier. This does not cover all the qualitative information that the client should regard, but it indicates a solution to some parts of the communication deficiency.

7 Conclusions

We have used third generation activity theory as a descriptive model for describing the digital preservation problem in terms of contradictions between three distinct activity systems, which we believe is a minimal configuration that covers the nature of emergent evolution of an organization with a preservation need, i.e. how time influences an organization's view of (preserved) information, and the implications of procuring preservation services “in the cloud”.

Notably, we see how the information production activity system interacts with the information preservation activity system in order to predict the needs of the information consumption activity system. At the same time, the information consumption activity system comes with motives of its own that may clash with those of the information production and preservation activity systems. Specifically there are serious problems related to mutual understanding between the information production...
activity and the information preservation activity regarding their joint responsibility for establishing a suitable preservation plan.

Regarding the choice of language for exchanging information about suitability of proposed preservation plans, we believe that transforming the result of quality assessments into risks that we can calculate a monetary value of is a practicable way forward for communicating some consequences to the information production activity system. Still there are other intersubjective factors of quality that are not easily translated into monetary values and we still do not have an answer to the question how we communicate around this. This latter problem is connected to the question which of the producer and the service provider that has the preferential right of interpretation of future needs of the information consumption activity system. It is evident that more work is needed in order to empower the information production activity system to make qualified decisions around preservation strategy and preservation plans that affects the future success of using the preserved information.

8 Future work

We have identified the following areas for future research.

• In order to address the lack of grounding of activity theory, we want to study the possibility of using boundary objects [20][21] to describe the communication deficiencies between the information producer and the information preservation service provider.

• Is it possible to use genre theory as a means to understand purpose (purpose of preservation and purpose of use) of stakeholders in preservation systems? The idea here is to look at historic and current use of information within an organization as a starting point for doing an extrapolation into future uses. At worst, it would only capture the status quo, but it would also formalize the interpretation of quality assessments towards a real-world scenario that could help the organization to make empowered decisions.

Acknowledgement

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A Systematic Process for Selecting a Typical Case in School Setting

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Abstract. This paper describes the rationale behind the concrete steps how we systematically have gone through the case selection process as the first phase of a research project named Consequences of the Digitalization of Schools. The project is a single-case longitudinal (5-year long) study and adopts a so called Whole-School Approach. Previous research has criticized case studies for lack of both systematic approach and transparency in the presentation of the case selection process. The purpose of the presentation of this case selection process is to contribute to enhancing understanding of and broadening knowledge on systematic and transparent case selection techniques. The SIRIS database has been used to select a typical Swedish primary school in the chosen municipality where the project will be conducted. The SIRIS database contains annually statistics from all primary schools in Sweden, and is available online for public use. We demonstrate how and why a particular school representing a so called typical school was selected as our case.

Keywords: Case Study Research, Case Selection, Purposive Selection, Whole-School Approach, IS Research Framework

1 Introduction

The Swedish school is currently experiencing a strong push for implementing new Information and Communication Technologies (ICT). Schools are increasingly investing in classroom technology such as interactive whiteboards and so-called 1-to-1 ventures. There is an upward competitive trend to equip each student and teacher with laptops. Schools increasingly use information systems (IS) to e.g., report student daily attendance, to support and monitor student progression and achievement. Furthermore, IS are also increasingly used by schools to communicate with parents, with the hope of bridging the gap and increasing interactivity between home and school. However, little is known regarding how this digitalizing of schools affects the diverse activities that signify schools as organizations and the involved actors such as students, teachers, headmasters, administrative personnel and parents.

In this paper, after briefly introducing the initial phase of a longitudinal (5-year long) case study research project entitled “The Consequences of Digitalizing Schools”
at University West, Sweden, we describe in detail how the case selection process is done. Previous research on case selection processes has called for a more transparent and systematic approach while selecting a case. Gerring (2007, p. 6) reports that there is a lack of documentation of: “…why a specific case or set of cases has been selected.” In addition Seawright and Gerring (2008, p. 294) postulate: “Despite the importance of the subject, and its evident complexities, the question of case selection has received relatively little attention from scholars since the pioneering work of Eckstein (1975), Lijphart (1971, 1975), and Przeworski and Teune (1970).” The main purpose of this paper is to demonstrate how we’ve gone through the case selection process and argue for the benefits of a systematic and transparent approach.

2 Research Method

Braa and Vidgen (2000) provides a framework in which case studies can be positioned based on what rationale the case study design was driven by as well as intended outcome of the conducted case study. The framework is based on the idea that research method can be mainly grouped into two distinctive categories of (1) positivist, and (2) interpretivist.

The framework is represented by a triangle shown in Figure 1 below. The triangle is comprised of dotted arrows, sides, and a constrained space. According to the authors (Braa and Vidgen, 2000), different positions on the dotted arrows represent intended research outcomes. If the research intention is to predict, then the case study would be positioned closer to the left in the triangle. Whereas, when intention is to gain understanding, then the case study would be positioned to the right. However, we are interested in the understanding notion which according to the authors (ibid) is aligned with the interpretive approach to research following Braa and Vidgen (2000).

![Figure 1. An IS research framework for the organizational laboratory (Braa and Vidgen, 2000; p. 255)](image-url)
Moreover, we can link the fundamental philosophical underpinnings of interpretation, following Braa and Vidgen (2000), to our single case Whole-school approach since the overall project aim is to getting a better understanding of the consequences of the digitalizing of Swedish schools, investigating a ‘typical’ school.

3 Literature on Case Study Research

Authors on case study research have defined case study to be a research strategy (Yin, 2012; 2003; Merriam, 1998), a research choice (Stake, 1995), and a research methodology (Bryman, 2008; Creswell, 2007; Gerring, 2010). Yin (2003, p. 13) defines the case study research as: “...an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used.”

Conducting single case has many advantages such as investigating a phenomenon both in-depth and during a long period of time to see if such a case is e.g., deviant, representative, or unique (Yin, 2003; Stake, 2005; Merriam, 2008). Gerring (2010, p. 187) states, when a case study researcher seeks to explain the outcomes of a investigated single case, he/she will base his/her reasoning on why something has occurred, or why; “something might have happened but, in the event, does not. This is, the outcome may be “positive” or “negative.”

According to George and Bennet (2005, p. 21), within a single case, the researcher looks at; “...a large number of intervening variables and inductively observe any unexpected aspects of the operation of a particular casual mechanism”. Similarly, Eisenhardt (1989, p. 534) defines case study as; “…a research strategy which focuses on understanding the dynamics present within single settings.” Literature on information systems (IS) reveals the use of single case study by many IS researchers (e.g, Walsham, 1995; Benbasat et al., 1987; Cavaye 1996; Darke, Shanks and Broadbent 1998).

Table 1: Purposeful sampling strategies and their definitions (Patton, 1990; pp. 182-183)

<table>
<thead>
<tr>
<th>Types of purposeful sampling strategies</th>
<th>Definition of the sampling strategy</th>
</tr>
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<tbody>
<tr>
<td>Extreme case</td>
<td>The case demonstrates unusual manifestation of the phenomenon, such as outstanding success and notable failures.</td>
</tr>
<tr>
<td>Intensity case</td>
<td>The case is information rich but not an extreme case.</td>
</tr>
<tr>
<td>Maximum variation</td>
<td>Cases, despite having diverse variations, exhibit important common patterns that cut across variations.</td>
</tr>
<tr>
<td>Homogeneous</td>
<td>Variation between cases is minimized, analysis is simplified and study is focused.</td>
</tr>
<tr>
<td>Typical case</td>
<td>Case illustrates what is typical, normal or</td>
</tr>
</tbody>
</table>
Besides various definitions of case study research which indicates that there is a lack of consensus among researchers, Gerring (2007, p. 6) reports that there is a lack of documentation of: “…why a specific case or set of cases has been selected.” In addition Seawright and Gerring (2008, p. 294) postulate: “Despite the importance of the subject, and its evident complexities, the question of case selection has received relatively little attention from scholars since the pioneering work of Eckstein (1975), Lijphart (1971, 1975), and Przeworski and Teune (1970).”

However, regardless of the aforementioned views on case study research concerning its discussed purposes, and particularly the literature on case selection techniques, we argue whether choosing a single-case or a multiple-case to study, it’s necessary to adopt a systematic and transparent approach to case selection process which is the main topic of this paper. In our study, we are searching for a Typical case (see table 1, based on Patton 1990) looking for a ‘typical Swedish school’.

<table>
<thead>
<tr>
<th>Case Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stratified purposeful case</td>
<td>Case illustrates characteristics of a particular subgroup to facilitate comparison and not for generalization or representation.</td>
</tr>
<tr>
<td>Critical case</td>
<td>Case that permits logical generalization to other cases because if it is true to this one case, it's likely to be true to all other cases.</td>
</tr>
<tr>
<td>Snowball</td>
<td>Cases of interest from people who know people who know people who know cases, rich information rich, good examples for study, etc.</td>
</tr>
<tr>
<td>Criterion</td>
<td>Cases picked because they meet some predetermined criterion.</td>
</tr>
<tr>
<td>Theoretical</td>
<td>The cases are manifestation of a theoretical construct and are used to examine and elaborate on it.</td>
</tr>
<tr>
<td>Confirming and disconfirming</td>
<td>Cases that elaborate on initial analysis to seek exceptions or test variations.</td>
</tr>
<tr>
<td>Opportunistic</td>
<td>Cases that emerge from following leads during field work.</td>
</tr>
<tr>
<td>Random purposeful</td>
<td>Cases are randomly selected from a large sample for the purpose of increasing credibility and not for generalization or representation.</td>
</tr>
<tr>
<td>Politically important case</td>
<td>Cases are selected or eliminated because they are politically sensitive cases.</td>
</tr>
<tr>
<td>Convenience</td>
<td>Cases are selected on the basis of minimum effort, time and money. They are candidate examples of low credibility, information rich cases.</td>
</tr>
<tr>
<td>Combination</td>
<td>Cases are flexible and meet different interests and needs cases.</td>
</tr>
</tbody>
</table>
4 Procedures in Previous Research Regarding Case Selection

In this section of the paper, we explore common ways of case selection. Yin postulates; as a first step, the researcher must initially define the “case” which should be derived from the primary research question which, in form of worded phrase, states exactly the focus of the research. Yin (2003, pp. 21-22) further argues that five components of research designs are particularly important (see Table 2 below).

Table 2: Five components of case study research designs

<table>
<thead>
<tr>
<th>Components of Research Designs</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Question(s)</td>
<td>Those fundamental research questions to be addressed and thus answered by the researcher should be “what”, “where”, “who”, “why” and “how”. Considering the case strategy, choosing “why” and “how” are the two most appropriate questions.</td>
</tr>
<tr>
<td>2. Propositions, if any</td>
<td>Propositions would deal with those possible links that a researcher will find. Example, the possible grounded outcomes, or expected finding results.</td>
</tr>
<tr>
<td>3. Unit(s) of analysis</td>
<td>Fundamental problem of “What” the case to be studied really is. E.G., a group of exemplary students is a possible unit of analysis.</td>
</tr>
<tr>
<td>4. Logical link between data and the propositions</td>
<td>E.G., the choice of some deployed techniques used to analyze the collected information, and to be later compared with the proposition(s).</td>
</tr>
<tr>
<td>5. Criteria for interpreting the findings</td>
<td>How to evaluate if findings support the propositions made or not.</td>
</tr>
</tbody>
</table>

He continues to say the researcher’s tentative definition of the third element of the unit of analysis, and thus of the “case”, is related to the way the researcher has defined her initial research questions. Yin (2003; p. 23) labels this as a “general guide.” It means only after the researcher has accurately specified the research questions, she can thereafter select some appropriate unit of analyses. In our longitudinal single-case study research project (i.e., The Consequences of Digitalizing Schools), the unit of analyses will be all those previous mentioned diverse activities that signify schools as organizations and the involved actors such as students, teachers, headmasters, administrative personnel and parents.

Other case study researchers such as Stake (1995; p. 4) states that the first criterion before deciding to select a case “should be to maximize what we can learn. Given our purposes, which cases are likely to lead us to understandings, to assertions, perhaps even to modifying of generalizations?” Learning is not the only criterion; Stake additionally proposes a list of criteria that are: (1) a typical unique case, (2) representative of other cases, (3) easy accessibility, (4) hospitality, (5) identification of informant(s), and (6) the intrinsic interest in the case.
As an example here, the hospitality criterion pointed out above means that the research environment, like a case study research in a school, must be indeed hospitable to our investigation. Similarly, the various positive contributions of informants/actors e.g., when doing case-study research in a school, are also invaluable. Informants, in our case, would be those identified students, teachers, and administrative staffs to simply cooperate with our research team e.g., in form of be willing to comment on a certain draft materials etc. Therefore, this is an important criterion as well. However, such an aforementioned list of criteria is what we can consider to be a part of the purposeful approach to case selection, or sampling strategy.

Moreover, Merriam (1994, pp. 3-4) discusses the issue of case selection criteria via her definition of case studies of interest. Merriam recommends the importance of one general- and three particular additional questions to be asked by the researcher before deciding to choose the best case of interest to study. These four questions are:

1. What types of questions the researcher should ask?
2. What degree of control the researcher has?
3. How the researcher would think what the final findings might be?
4. Could the researcher possibly identify a bounded system as focus of her research?

She argues question number four is probably the ultimate factor before deciding to select the best case of interest to be studied. She raises the issue of a bounded system which according to her is a system where the boundaries are clear as it’s shown by question number 4 above. As an example and in school setting, a particular teacher, school, or a research method can all serve as clear boundaries. The bounded system could be counted as a good case selection criterion candidate as well.

Rowley (2002) has noticed three case selection factors that are: (1) Time, (2) Accessibility, and (3) Resources. Not having just access, but easy access to the case is also one crucial criterion. These factors are supported by other case study research authors such as Yin (2003), Stake (1995), Seawright (2008) and Gerring (2010). Furthermore, Seawright and Gerring (2008, p. 295) note that due to the lack of a well-formulated “formal treatments” researchers continued to focus on a pragmatic approach meaning they continue to lean primarily on following factors: (1) Time, (2) Money, (3) Expertise, (4) Access, and (5) Theoretical prominence of a given case.

However, the process of case selection is dealing with search for finding all necessary criteria in order to justify the final selected case(s). A case study researcher must be prepared to defend her final selected case, it’ll say; must be able to answer questions such as why not selecting other potential available alternative case(s). In other words, one main crucial question which to be asked is: what makes e.g., case A to be preferred to case B? This is what we’ve attempted to demonstrate in this paper by describing our systematically purposive case selection process.

5 Selecting the Typical Case

While Stake and some other well-referred case study research researchers, such as Yin and Merriam, have covered the earlier mentioned aspects of case selection
criteria, Seawright and Gerring (2008) discuss the advantages of using purposive sampling case selection technique but rather in a statistical way. Purposive sampling can be shortly described as a stratified sampling technique by which some of those earlier mentioned criteria can be linked to whether a single case or a subset of the whole population of interest in order to see which case/cases can fulfill the pre-determined required criteria. However, in the subsequent sections we’ll discuss both the rationale behind and as well describe how we use mixed methods sampling techniques.

The ‘typical case’ has been defined by Seawright and Gerring (2008, p. 299) as a case which has its main focus on exemplifying: “...a stable, cross-case relationship. By construction, the typical case may also be considered a representative case...” These authors (p. 295) state: “In the absence of detailed, formal treatments, scholars continue to lean primarily on pragmatic considerations such as time, money, expertise, and access. They may also be influenced by the theoretical prominence of a given case. Of course, these are perfectly legitimate factors in case selection. Yet they do not provide a methodological justification for why case A might be preferred over case B.” Thus, this is one reason why we need a more transparent and robust procedure when selecting a case, relevant for the research approach adopting a whole school approach combined with our adoption of an IS research framework discussed in research method section of this paper.

Gerring and Seawright (2007) advocate the use of various regression diagnostics to identify cases that would be of (1) typical, (2) deviant, and (3) influential amongst other types of cases. They describe how to use statistical matching procedures as a useful way to formalize a notion of most-similar cases. As Gerring (2010, p. 92) wrote: “...the more common employment of the typical-case method involves a causal model of some phenomenon of theoretical interest.”

In comparison with the more common selection procedure of finding a good case based on pre-established selection criteria, the statistical matching method is argued to have some advantages The main argument in the case selection via statistical matching method is its more rigorous character and thus preferable particularly when there are many relevant variables (Nielsen, 2012; Gerring and Seawright, 2007; Gerring, 2010). Gerring (2010, pp. 88-90) provides techniques of case selection for nine case study types, one of which is the “typical case” defined to be “representative” by definition. According to Gerring (p. 91), in order for a focused case study to provide insight into a broader phenomenon, it must be representative of a broader set of cases. It is in this context that one may speak of a typical-case approach to case selection.

The typical case exemplifies what is considered to be a typical set of values, given some general understanding of a phenomenon. By construction, the typical case is also a representative case; I employ these two terms synonymously.

Teddlie and Yu (2007, p. 78) offer a taxonomy of sampling techniques shown in Table 4 below. These authors view purposive sampling such as typical case to be criteria-based sampling. Furthermore, and in line with what Gerring’s definition of typical case, Teddlie and Yu (2007, p. 81) underline the purpose of selecting a typical case is to achieve “representativeness or comparability.”
Table 3: Taxonomy of sampling techniques for the social and behavioral sciences (Teddie and Yu, 2007, p. 78)

<table>
<thead>
<tr>
<th>I. Probability Sampling</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Random Sampling</td>
</tr>
<tr>
<td>B. Stratified Sampling</td>
</tr>
<tr>
<td>C. Cluster Sampling</td>
</tr>
<tr>
<td>D. Sampling Using Multiple Probability Techniques</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>II. Purposive Sampling</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Sampling to Achieve Representativeness of Comparability</td>
</tr>
<tr>
<td>B. Sampling Special or Unique Cases</td>
</tr>
<tr>
<td>C. Sequential Sampling</td>
</tr>
<tr>
<td>D. Sampling Using Multiple Purposive Techniques</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>III. Convenience Sampling</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Captive Sample</td>
</tr>
<tr>
<td>B. Volunteer Sample</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IV. Mixed Methods Sampling</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Basic Mixed Methods Sampling</td>
</tr>
<tr>
<td>B. Sequential Mixed Methods Sampling</td>
</tr>
<tr>
<td>C. Concurrent Mixed Methods Sampling</td>
</tr>
<tr>
<td>D. Combination of Mixed Methods Sampling</td>
</tr>
</tbody>
</table>

5.1 Data Analysis and Results: Framing the Typical School

For the purpose of framing the typical school, we used the SIRIS\(^1\) database available online at The Swedish National Agency for Education (Swedish: Statens skolverk, commonly known as Skolverket) website. Each year, Skolverket provides school performance statistics for all public and private primary schools (Grades 1-9) that are spread across the whole country. Our mixed methods (MM) sampling techniques for case selection comprises of two steps: Firstly, based on quantitative data retrieved from SIRIS database we compared all primary schools (N=1665) in Sweden with respect to 128 variables (e.g. average grades, number of staff, percentage of students that qualifies for upper secondary school etc.). By calculating the means and standard deviations of all variables it was possible to explore the characteristics of a “typical Swedish school”. Secondly, we created a set of criteria for a purposive selection of a single case.

In SIRIS database, all data about primary schools (Grades 1-9) were retrieved at (a) the school level, and (b) at the municipality level. The data were consisted of more than 200 variables measuring school performances such as the final average degree in each subject for each school in Sweden. But we’ve decided to select only 128 out of 200 variables that we identified to be relevant variables. We identified those

\(^1\) [http://siris.skolverket.se](http://siris.skolverket.se)
remaining 72 (i.e., 200-128=72) variables to be irrelevant because, for instance, variables such as “The percentage of students whose parents are migrants” or “The school annual budget” lack useful information in our case. For example, we don’t know how much of a school’s total annual budget actually goes to ICT budget or IT department if there is any such, therefore annual budget was excluded. Similarly, a variable such as the percentage of students whose parents have migrated to Sweden is very low in the most schools that are particularly located in neighborhoods with very low-to-zero percentage of migrants. Therefore, these types of variables have been omitted due to their irrelevancy to our case selection reasoning.

After reducing the original 200 variables to 128, we computed the means and standard deviations of these 128 variables. In order to define what constitutes typical values for each variable, we calculated the width of an interval surrounding the mean value. Chebyshev’s inequality theorem was used for this purpose. Chebyshev’s theorem states that regardless of the shape of the distribution (e.g., bell, skewed, bimodal, etc.) for any given K>1, at least \(1-1/K^2\) of the population lie within \(\mu\pm K\sigma\).

We decided to use \(K=1.414\) which captures at least 50% of the population for each variable. In order to provide a practical solution for the longitudinal study, we selected the municipality of Trollhättan as the best choice based on proximity to the university as well as falling within the area of operation of the research sponsor. Trollhättan has 9 schools that met the requirements (public school with grades 1-9).

For each of the nine schools we explored how many of the 128 variables that were included or excluded in relation to the selected K-value. In Table 4 below the percentage of included and excluded variables are summarized.

<table>
<thead>
<tr>
<th>School/case names</th>
<th>%Variables included of total 128</th>
<th>%Variables excluded of total 128</th>
<th>%Variables missing of total 128</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kro1</td>
<td>29%</td>
<td>28%</td>
<td>44%</td>
</tr>
<tr>
<td>Syll</td>
<td>58%</td>
<td>10%</td>
<td>33%</td>
</tr>
<tr>
<td>Sta1</td>
<td>48%</td>
<td>4%</td>
<td>48%</td>
</tr>
<tr>
<td>Skg1</td>
<td>44%</td>
<td>8%</td>
<td>48%</td>
</tr>
<tr>
<td>Sjt1</td>
<td>48%</td>
<td>5%</td>
<td>47%</td>
</tr>
<tr>
<td>Str1</td>
<td>52%</td>
<td>4%</td>
<td>44%</td>
</tr>
<tr>
<td>Hjm1</td>
<td>51%</td>
<td>4%</td>
<td>45%</td>
</tr>
<tr>
<td>Par1</td>
<td>60%</td>
<td>3%</td>
<td>37%</td>
</tr>
<tr>
<td>Lyr1</td>
<td>57%</td>
<td>3%</td>
<td>40%</td>
</tr>
</tbody>
</table>

We decided on the ≤5% limit regarding excluded variables and ≥50% limit regarding included variables. Based on that decision, four schools were included in the range of the decided definition of a ‘typical school’ (i.e., Str1, Hjm1, Par1, and Lyr1). Based on firstly the percentage of included variables and secondly on percentage of excluded variables, thus these below four selected schools were ranked in this order: Par1, Lyr1, Str1 and Hjm1.

As our final step of the case selection process, and derived from our conclusion based on the data showed in Table 4 above, we’ve thus contacted those above four
purposive selected schools since we needed to address other types of criteria. These criteria are linked to the requirements for long-term commitment particularly necessary for the longitudinal Whole-school research approach focusing on the consequences of the digitalization of schools. The suggested criteria in the next phase are presented in Table 5 showed below.

Table 5: A list of case selection criteria (inspired by Stake, 1995 & Rowley, 2002)

<table>
<thead>
<tr>
<th>Management commitment; Time</th>
<th>Easy accessibility</th>
<th>IT infrastructure &amp; Resources: Hardware Software Internet access</th>
<th>Availability and interest of informants and actors</th>
</tr>
</thead>
</table>

First we did an interview with the IT manager of all public schools (Grades 1-12) in Trollhättan municipality. Our main aim of the interview was to get some useful information on those criteria shown in Table 5 above. Derived from the mentioned interview with the IT manager, we’ve now know about parameters such as IT investments in those schools, and particularly we asked him about teacher attitudes toward the inclusion of ICT in their daily classroom teaching practices.

During the interview with the IT manager, it became clear that some schools have a clear articulated IT budget, and particularly a clear vision as well positive tendency toward the implementation of ICT in their organizations.

As the first and preferred candidate for the single case study based on the work with the SIRIS data base, the school Par1 was contacted. First, the project was presented for the headmasters of the school. Then, a week later, the same presentation was made for the whole school staff. It was of uttermost importance to get their consent and willingness to participate in the longitudinal project which will be conducted in their school. Thus, they were willing to participate in the 5-year long single-case study research project at their school where the project will be conducted.

6 Conclusion and Further Work

As a contribution to the case study research, we have discussed the case selection issue in order to both enhance the knowledge and also to broaden the awareness of case selection process as the first part of case study research, and regardless of choosing to conduct a single-case or a multiple-case study research. In educational settings and with emphasis on adapting what is known as whole-school approach to education for considering all involved stakeholders, a thorough case selection process should be the first phase before starting with the investigation process of the case study research.

We showed how four out of the nine finally selected schools were statistically qualified as potential candidates. These schools were generated by our proposed case selection process in which we searched for ‘typical’ schools. All four schools fell outside of the defined interval for less than 5% of all variables. Based on the rank order of the four schools, Par1 has emerged as the primary candidate. Consequently, these schools are defined as ‘typical’ in relation to the schools in Sweden.
Furthermore, compiling the quantitative data from the SIRIS database will make it possible for us to follow change over time.

As the next step, interview with headmasters and other representatives for those schools have finally led to an agreement and long-term access to the particular school which is now Par1. This school will be investigated during our longitudinal 5-year long single-case study research, and we have been able to demonstrate why Par1 was selected as the preferred candidate with a systematic and transparent approach.

As our final conclusion, we recommend case study researchers to go through the case selection process systematically and present the approach as transparency as possible. It is not only of value for the justification of the selected case. It is also of high value as a learning process about the specific area of investigation and getting an understanding of the case as such beneficial for the next phases in the research project.

Acknowledgements

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References

‘Participation’ in the Context of Building a Large Scale Information Infrastructure – a ‘Future School’ Case

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Abstract. This paper examines the building of an information infrastructure for an educational network, focusing on its participatory development involving various actors. A discourse analysis was performed following nexus analysis that extends the focus from micro level to organizational and institutional dimensions. The paper contributes by offering a careful analysis of what participation entails in this case, acknowledging both users and other stakeholders. Discourses justifying broad participation of actors are identified as well as users’ concrete participation practices. Discourses arguing for challenging, while also for appreciating and utilizing, the existing installed base were identified as well as discourses advocating equality, sustainability, continuity and cutting-edge solutions. Those all justified wide-ranging participation of various actors. In practice, users had varying possibilities to influence the co-evolution of practices and technology teachers having more influence than pupils. The importance of enabling practices – supporting participatory information infrastructure building – was also identified.

Keywords: Information infrastructure, participation, children

1 Introduction

This study focuses on the participatory process of building an information infrastructure [24] for an educational network of a Finnish city. The educational network refers to local schools and the municipal educational administration. In the initial stages of the process, the city encouraged the schools in the district to submit applications for development projects. Through this process teachers and headmasters were invited to participate in a ‘future school programme’ to develop school culture and to look for the best practices in pedagogy and technology use for ‘school in the 21st century’, ‘the future school’. Ten schools were shortlisted as ‘Smart Schools’, i.e. pilots in technology use and renewal of pedagogic practices. The best practices from the Smart Schools were to be utilized in a future school, so-called ‘Integrated Pilot School’, which was under construction in a new town area. The school was to be built as part of a multipurpose centre also including a library, a nursery, a school as well as other facilities and services. Experiences of the best practices from the conducted pilot projects were to be exploited in the Integrated Pilot School and later to be extended to other schools in the city and the whole country.
Various actors have been active in the effort, including the educational authorities as well as school staff and children. This case allows us to contribute to the topic of user participation in Information Systems (IS) research, in which user participation has been a traditional topic of study, but as the nature of IS practice has changed, new challenges and perspectives have emerged and the traditional IS participation theory has become deficient. As a response, Marcus and Mao [15] have, among other things, made explicit the concept of ‘actor’, which they argue was largely implicit in traditional theorizing. Today’s IS projects often affect many more stakeholders than was the case earlier. Not only do today’s IS projects affect more users; they also affect more types of users. Altogether, there is a need for a fine-grained conception of participants and participants’ proportions of various affected stakeholder groups. [15]

This paper thus offers a fine-grained analysis of participation of various actors in this complex case including both users and other kinds of stakeholders. This study utilizes literature on user participation and literature on the development of complex information infrastructures, within which some studies have already discussed participatory processes for infrastructure development [4], [11], [18]. This study can be located between research arguing for participatory design in information infrastructure development efforts [18] and research discussing participatory design ‘in the wild’ as a natural part of information infrastructure building [11]. In this case, the participatory process has emerged without our intervention. Novel in our study is also the focus on pupil’s participation, among other actors. Children’s participation has not been studied before in information infrastructure development efforts (except in [blinded for review]), although there is existing research on interaction design with children, but within this research the development efforts have small-scale, i.e. particular design or evaluation sessions have been carried out with children with a genuine interest in working with them (e.g. [2], [3], [19]). In information infrastructure building efforts with a multitude of actors the integration of children into the development is evidently more challenging.

We will examine the topic through a discourse analysis of thematic interviews with the key persons responsible in the effort. The study relies on the broader research framework of nexus analysis [21], which allows extending the perspective from the micro level to the organizational and institutional levels of social analysis that are necessarily intertwined. Nexus analysis provides tools to explore participation as social action [20] from the point of view of concrete practices and wider discourses. The present study examines how participation of the various actors has evolved over time in such a complex setting, acknowledging participation both as discursively constructed and as executed through practical activities within the effort.

The structure of the paper is the following: The next section presents literature on user participation, including also some studies on children’s participation. The third section introduces the concept of information infrastructure and literature on designing information infrastructures. The fourth section describes the research method as well as the procedures of data gathering and analysis. The fifth section outlines the empirical results and the sixth section their implications and limitations.
2 Research on User Participation and Children

It has long ago been acknowledged that users should somehow take part in ICT development [15]. Participatory Design (PD) research has even emphasized that users have the right to take part and have a say in ICT development affecting their lives. However, the political concerns of the PD tradition have decreased in importance lately. It has also proven out to be challenging to enable every user’s participation and power of decision in contemporary ICT development that has extended outside the workplace [13], [15]. There is also variety in the roles offered for users. User participation may be divided into three types. In ‘consultative’ user participation, data related to users is gathered and used as a basis in decision-making, but the decision-makers are not required to comply with the data. Within ‘representative’ user participation, a group stands for a larger user population, i.e. selected or (preferably) elected user representatives are involved in the design process and assigned some decision-making power. Within the ‘consensus’ type, the goal is to enable all those affected to take part in the design process and to have decision-making power. [17.]

This may be impossible, however, due to practical reasons. For example, those affected may be too numerous or unreachable [13], [15]. In this case it has been relatively common to rely on user representatives that are not users themselves, such as on some interest groups representing users’ interests as in PD projects [13]. ‘Professional’ user representatives, such as usability specialists or ethnographers, assumed to ‘know the users’ and to ‘speak for the users’ may also be involved in the development (e.g. [7], [9]). One might ask, however, where from and how do these user representatives gain legitimacy for their work, as users might not even be aware of others ‘standing for them’ in the development as their representatives [7].

Children’s participation in ICT development has been tackled in the studies on interaction design with children. During the early days, the focus was on children as users of ICT and on the consequences and impacts of the ICT on children. The focus has moved on involving children as testers, informants and design partners [3]. However, in ICT research there is a lack of studies on children’s involvement in more complex cases, with a longer time span or many partners (see a review in [blinded for review]). However, there are some such studies carried out within other disciplines. Next, some relevant studies of this kind are presented.

In a study exploring the social shaping of educational technology, the notion of participation and valuation for inclusion of various social groups, including schoolchildren, was brought up [12]. However, children were not involved directly in the development of educational technologies. Instead, in the analysis of strategic and political issues concerning educational technology in the project, schoolchildren were identified as a relevant social group. The study aimed to widen the perspective on the development and adoption of technologies in education, not only as technology-driven but as influenced by relevant social groups, e.g. schoolchildren. [12].

In another study, children were directly involved in developing and implementing a participatory approach in a children’s ICT project in a voluntary childcare organization. The aim was to improve access to and usage of ICT by disadvantaged children and their families. The initially one-year-project included training sessions at six sites with local youth projects and community centres. Community development and child-centred participatory approaches were applied to encourage children’s
participation and parents’ involvement. During the learning sessions, active participation, shared decision-making and maintenance of ongoing attendance were encouraged. Children were also encouraged to take the lead in their choices during the activities. [1.]

Children’s participation as co-researchers has been explored in the children’s participatory action research (PAR) study conducted within the UNICEF initiative on child participation. It aimed to identify what it is that supports and hinders child participation. Children collaborated in three municipalities with Support Groups (adults who helped children implement their activities). A Children’s PAR Group consisted of approximately 20 children (aged 12-14 years), who participated in choosing members for their Support Groups. At the beginning, children were informed about the methodology and earlier studies in the field. They prepared presentations on issues they wanted to address and questions used in subsequent discussions. They identified activities they found lacking in their communities, through which they wanted to support child participation. Finally, based on their research, children identified several issues supporting child participation. [14.] In all the studies presented above, children’s genuine participation was considered meaningful, adding value for the surrounding society. Children’s contribution and their role varied somewhat but in all these studies enabling children in shaping their own environment was seen as an empowering aspect. This is highlighted in the present study as well, while concentrating on the ICT context.

3 The Definition and Design of Information Infrastructure

Star and Ruhleder [24] see infrastructure as a sociotechnical, “fundamentally relational concept, becoming real infrastructure in relation to organized practices” (see also [22], [10]). They [24] have characterized the salient features of infrastructure through eight features: 1) Infrastructures are embedded in other social and technological structures (embeddedness). 2) The supporting tasks are transparent (transparency). 3) Infrastructures have a certain reach or scope. This may be either spatial or temporal - infrastructure has reach beyond a single event or one-site practice; 4) They are learned as part of membership (the artifacts and organizational arrangements are taken for granted). 5) Infrastructures shape and are shaped by, or linked with the conventions of practice. 6) Infrastructures are plugged into other infrastructures and tools in a standardized fashion, though they are also modified by scope and conflicting (local) conventions (embodiment of standards). 7) Infrastructures are built on an installed base, i.e. they do not grow de novo but wrestle with “the inertia of the installed base” and inherit strengths and limitations from that base. [24] ‘The inertia of the installed base’ refers to the influence of the existing base of infrastructure, which the new elements always have to be adapted to. The infrastructure is evolving and never built from scratch, which then influences the possibilities to change and design the new elements of the infrastructure [4]. New systems are designed for backward compatibility; and failing to account for constraints may be fatal or distorting to new development processes [16]. Finally, 8) the normally invisible infrastructures become visible upon breakdown.
Star and Ruhleder [24] see infrastructure as evolving while the locally tailored technologies become interwoven with the elements of the formal infrastructure. Infrastructure is thus shaped by the conventions of a community of practice while these, again, have to be adapted to the existing infrastructures, i.e. these elements are intertwined, shaping each other. They argue that in organizations the locally–tailored applications and repositories begin to interweave themselves with the formal infrastructure to create a unique and evolving hybrid. Thus the emergence of a transparently supporting infrastructure is “organic” and evolving in response to the community evolution and adoption of infrastructure [24]. As the information infrastructures have to support current conventions in local organizations, they also have to be changeable in order to support also the evolving practices and use involved. An infrastructure emerges when the tension between the local and the global is resolved and local practices are afforded by a larger-scale technology, which can then be used in a natural, ready-to-hand fashion [24].

The development of infrastructures is considered as processual, evolving and constructed over time on the existing installed base [24]. Star and Ruhleder’s [24] definition of infrastructure also implies that the technologies to be developed should be seen in relation to organized practices, as part of the social and organizational structures where the infrastructure is embedded. Star and Bowker [23] share this view of infrastructure as relative to working conditions and never apart from the people who design, maintain and use it. As regards the socio-technical design process and the political and ethical concerns in the design of infrastructures, they [23] consider the Scandinavian school of PD successfully responding to these challenges. The participatory design of infrastructures has been accordingly examined in other studies with the socio-technical approach [11], [18].

Neumann and Star [18] have weighed the possibility to apply design principles of PD in a large information infrastructure building effort. As social scientists co-developing an information infrastructure, they aimed at understanding the ways in which potential use, new and old infrastructure, and large project organization interact in the context of larger digital library projects (six US government-funded projects at different universities). During the study, they collaborated with users and developers following the ideas of PD. The potential and actual use of the working prototypes constructed by the developers were examined through usability studies with the emergent test-bed (prototype), observations on current library users, focus groups with potential users and interviews with students and staff. They characterize infrastructure building as mediating demands of multiple groups and making connections between them possible, reaching towards the unknown. In their case, they needed to bring together funding agencies, publishers, software developers, librarians and users, each of these having their own interest and idea of what the unknown would be. However, during the infrastructure building process they discovered that articulating the end product or the meanings of the project as a whole were difficult and differing for people working on it.

Karasti and Syrjänen [11] explored PD ‘in the wild’ in two communities sharing features in collaboration in ICT design. They revealed the importance of broadening existing understandings of the social and organizational context of where PD traditionally takes place by extending the study of community ICT development even to the nonprofessional designers ‘in the wild’. ICT development in both communities
has been characterized as thoroughly and complexly embedded and interwoven in the activities of the communities. In both communities, the blurring of boundaries between use, tailoring, maintenance, reuse and design, as well as attention directed to local, situated everyday practices with technologies, have been forming design as artful infrastructure processes which are tentative, open and flexible. [11.]

4 Research Design

The aim of this paper is to shed light on the process of participation in information infrastructure building. The development effort spanned years 2007-2010 and was in progress at the time of this study. The study was guided by the research framework of nexus analysis (NA), which focuses on social action that is any action taken by an individual with reference to a social network. [21.] Social action is viewed as being mediated by cultural tools or mediational means [20], discourse being one by which social action may be taken. Discourse is also viewed as one among the means by which society and culture is constituted. [20] NA examines the cycles of discourse that come together to form a nexus of practice, a recognizable group of mediated actions and it proceeds through three cycles. The researchers first enter the community being researched, looking for important social actions to be studied and key actors, thus, engaging the nexus of practice. They continue by navigating the nexus of practice through various methods and data. By participating in the practices they are also involved in changing them. [21] NA was seen as a fruitful choice in the study of the complex process under scrutiny as it may unify the micro-analysis of social interaction and a broader socio-political-cultural analysis of the relationships among social groups and power interests in society.

The nexus of practice that this study addresses is the development of the school for the future, encompassing the concept or ideology of a ‘school for the 21st century’ where children are apt technology users. This involves the concrete aim of designing a new school building in a Finnish city (the Integrated Pilot School) as well as technology-mediated pedagogical practices for even broader use. The process was facilitated through information infrastructure development involving new solutions in ICT as well as pedagogy, architecture and interior design for the whole educational network of the city. The participants in the effort include educational authorities of the city, different kinds of companies, researchers, and the Smart Schools including their headmasters, teachers and pupils.

On the basis of a broad discourses survey [21] the most important participants in the nexus of practice, either due to institutional status or media representation, were identified from the research data. Those participants were selected as the interviewees of this study. Two of the interviewed key persons were project managers [interviewee 2 and interviewee 3] in the future school development endeavour, two were headmasters of the Smart Schools [interviewee 1 and interviewee 5], and one a city level development manager [interviewee 4]. The research data includes also interviews of two Smart School teachers [interviewee 6 and 7].

The data include interviews with these seven actors involved in the development effort as well as a considerable amount of documentation related to the future school
concept and the infrastructure building effort (e.g. minutes, city web portal pages, project pages, different kinds of reports, newspaper and magazine articles, material produced by the involved schools). With the ‘key actors’, the future school development effort was discussed in the in-depth interviews based on the prepared themes of 1) background and history, 2) the nature of the effort, 3) collaboration between the public, the business and the research sectors, 4) building the ICT infrastructure and technology use, as well as 5) the community aspects and future visions concerning the new town area and multifunction centre including the Integrated Pilot School there. This thematic interview guide was applied flexibly in the collaborative interview situation. With the Smart School teachers, the following themes were discussed: the purchasing process, acquisitions for schools and taking users into account in purchasing. The interviews, approximately one hour each, were transcribed. Interviewing children was not done as the numerous children involved in the conducted projects were dispersed in the different schools of the city, and information on the future pupils of the to-be-developed Integrated Pilot School was not available. The interviews and the collection of other data took place as part of ‘engaging’ the nexus of practice, when the researchers were looking for attachment points with the various social actors in the effort. The study then continued as ‘navigating’ the nexus of practice through an analysis of discourses circulating around.

The analysis proceeded through a succession of data-driven stages. In the first phase, the researchers worked on the data making initial observations and becoming acquainted with the data. Next, an in-depth analysis was made on one of the interviews mapping the topics discussed by the interviewees and the discourses that were seen to emerge in the course of the talk. Thereafter, the analysis was extended to the rest of the data. Afterwards, the theoretical framework presented in this paper was applied to make sense of participation in the case. Three Star and Ruhleder’s dimensions [24] that particularly well characterized the case were used as special perspectives into the effort: its reach and scope, the issue of the infrastructure being built on an installed base, and, its links with conventions of practice, i.e. how the infrastructure both shapes and is shaped by the conventions of a community of practice. The participation of the various actors in the case was considered in relation to these three dimensions. This study characterizes the nature of participation in a complex information infrastructure building case, acknowledging participation both as discursively constructed and as executed through practical activities within the effort.

5 Participatory Building of Information Infrastructure

In the construction of the future school concept and its information infrastructure building, openness for various actors to participate has been emphasized from the outset. Representatives from a global and several local companies including technology and interior solutions suppliers and companies developing ICT solutions have been involved. The Smart Schools contributed through smaller scale development projects (‘pilot projects’) advancing the local, school-level goals and
activities. The Smart Schools have offered living lab environments, where new technological solutions have been trialed and developed.

Collaboration has involved headmasters, teachers and some schoolchildren participating in the pilot projects in the schools. Furthermore, a general orientation for community participation, emphasizing both parents’ and schoolchildren’s involvement in the process of construction of the future school can be identified from the background documents characterizing the case. Researchers have also been invited to contribute to the future school concept construction process and assessing the impact of the renewed pedagogical practices.

Next, we will discuss this case with a focus on its participative aspect. Discourses justifying and characterizing participation in the case are identified as well as users’ concrete participation activities.

5.1 Discourses arguing for challenging but also appreciating the installed base

Star and Ruhleder [24] stress the influence of the installed base on all future developments. Information infrastructures always inherit strengths and limitations from the installed base [24]. The influence of the installed base has been addressed in many ways in this case. On the level of discourses, the various actors involved have, on the one hand, been invited to challenge the installed base, while, on the other hand, the existing installed base has been positioned as highly valuable and the adaptation to local settings highlighted. In both cases, the discourses identified have contributed towards justifying broad participation of different kinds of actors in the case.

The invitation to participate to challenge the installed base has been brought up through the discourses describing the vision of challenging the ‘traditional school’ for constructing the future school concept and information infrastructure. The installed base of the infrastructure of the traditional school has been envisioned to be modernized through the process of constructing the future school with the pedagogical practices and learning environments of the 21st century, the future school being discursively constructed as follows: ”It is a kind of ideology, which involves a consideration of the learning environments of the 21st century, learning in the 21st century. How should the traditional school boat be updated, then, for us to reach these, to offer our future experts the skills of the 21st century in the changing world?” [Interviewee 2] The renewal of the technological equipment has been legitimized with the technological skills of the children in their everyday-life ”as children already have at home their computers and mobile phones.” [Interviewee 1] In the interviews, a discourse on all-embracing renewal was brought up. It was needed for the change towards the future school, involving experts of various kinds: on teacherhood, leadership, physical learning environments, technology etc. ”And there is change … we want to develop the whole or in other words develop all of it as a whole… On all levels something has been done – teacherhood, leadership, physical learning environment, infrastructure, technologies.” [Interviewee 2]

However, the effort has involved not only arguing for challenging the installed base. The educational authorities interviewed also emphasized the importance of the local actors’ knowledge of the local settings, referring to the installed base: ”We [in the educational section] believe in the constructivist view in this development work,
too, that it has to be created within the organization and there you have the knowledge once you find it and share it and that is where the best practices emerge.”[Interviewee 4] The schools have profiled their own strategies for their educational development projects and for the adoption of learning technologies based on the installed base of their school. This way of working has been positioned as necessary, while the way of building a model and then transferring it to different contexts as ‘old-fashioned’: “This model is good for starting to support the schools in this way, so that they get started from their own profiles and utilize their own practices and search for those strengths, take them forward. But the transferability of such models is sort of old fashioned thinking.” [Interviewee 4] For the reason of appreciating the installed base of each school, broad participation of schools is required.

5.2 Discourses arguing for equality, sustainability, continuity and cutting edge solutions

According to Star and Ruhleder [24], infrastructure has temporal and spatial reach beyond a single event or one-site practice. In this case, discourses arguing for extending the temporal and spatial reach of this information infrastructure even further have been evident. Discourses arguing for equality, sustainability, continuity and cutting edge solutions call for extending the reach of this information infrastructure, justifying broad participation of different kinds of actors in the case.

The discourse on equality identified from the data has demanded broadening the development of a single school, the integrated pilot school, to concern also other city schools. The new integrated pilot school to be built was from the outset planned to become a model for other schools, where new learning technologies with new practices would be developed and further exposed to other schools. However, discourse on equality in education becomes prevalent and argued for as providing equal opportunities to all schools in the city if not even nationally, e.g. through a similar level of technological equipment: “At that stage in the educational administration it was wisely determined that we cannot be building one innovative school, one elitist school in a way that other schools envy” [Interviewee 2] “They [learning technologies] just simply are so much better when compared to this former range of equipment and there is already so much well-functioning, usable material that should be available in every single school in Finland, in every municipality.” [Interviewee 1] Broad participation of schools and collaboration on national level are therefore necessary.

The continuity of the development effort from the viewpoint of the school children has also been placed into an important role. For instance, in one of the smart schools collaboration with the other local schools for ensuring continuity for the children has been considered necessary: “Our contribution with respect to this age group ends on grade six, but it is not the aim to finish with that age group but create ground for them for continuation so that they could then until the end of comprehensive school utilize or use the methods that we have here launched. Enrich and develop them.” [Interviewee 1]. The pedagogical practices employed with the new learning technologies have been envisioned to be further applied in the elementary school with
smaller children as well. This emphasis on continuity again justifies the inclusion of numerous schools into the effort, through cooperation with other schools at least.

Furthermore, the discourse on sustainability was also evident in the data. This emerged, for example, in the talk of the interviewee representing educational authorities emphasizing the importance of the possibility to continue with the practices and technological solutions in schools developed during the pilot projects: “One should find such sustainable solutions that can be funded even if the economic situation deteriorated a little.” [Interviewee 4] The development of the infrastructure for the educational network of the city had been started mainly by applying funding for separate pilot projects, but the development work has since been considered as part of the continuous development in the educational administration of the city.

An emphasis on world-class, most up-to-date, cutting-edge solutions was also evident in the interviews, the interviewees highlighting how they have relied on ‘technologies as innovative as possible’ [Interviewee 2] or arguing how ‘we have tried to be a few years ahead’ [Interviewee 3]. The process has been characterized even as “soaring” [Interviewee 1] or taking “quantum leaps” [Interviewee 4] in the technology development. This can be connected with collaborating with the global network, related to which a vision of ‘bringing the technological solutions all over the world’ [Interviewee 2] was boldly expressed. The educational authorities and project managers indeed have collaborated within the global network with pedagogical and technological experts to define the general goals for action in constructing the future school of the city. Via the network, participants have been able to visit other schools or sharing experiences internationally: “we have together met other schools, developer schools, internationally and there has been teacher-, headmaster-, (…) and then also the representatives from [the global company]. (…) There have been international experts related to learning (…), at every stage we have figured out the experts, who have given their own input to this work” [Interviewee 3] The need for cutting edge solutions has justified the inclusion of even global companies and schools into this information infrastructure building effort.

5.3 Concrete participatory practices among teachers’ and pupils’

Star and Ruhleder’s notion of infrastructure [24] stresses its socio-technical nature which implies that infrastructures are always shaped by the conventions of a community of practice while these conventions of a community of practice, in turn, also have to be adapted to the existing infrastructures [24]. In the process of constructing the future school the adopted technological solutions and pedagogical practices have entwined as pedagogic practices have been developed along with technology to meet the needs of the learning objectives in the future school. A learner-centred view has been raised as a basis for shaping pedagogical practices. Supporting the personal objectives of each learner as well as viewing learning in a wider context have been given as a foundation for the use and in some cases also the selection of the learning technologies. The learning environments were constructed with the ICT solutions (e.g. ICT providing remote connection and access to information) supporting both collaborative practices and personalization of teaching.
The concrete participatory practices shaping the ICT and pedagogical practices have mainly been carried out by teachers in this case, while also pupils have played a role.

Especially teachers’ contribution in developing the pedagogical practices linked with the information infrastructures has been crucial. The teachers have contributed both within the general framework of curriculum and in more specific-level projects. The Smart Schools have created new practices supporting teachers’ development work. Instead of detailed pre-planning, the development work has been characterized as evolving: “We haven’t had and we cannot have had such a detailed preliminary model, how we will proceed, but we have sort of created it all the time in the course of the process (...) We have for example started creating this co-teaching system so that when the goal is to get teaching and learning more learner-centred, and also utilize these teacher strengths, strengthen the teachers’ wellbeing, innovation, those models that have sort of been developed during the process.” [Interviewee 1]

Within the pilot projects, teachers have brought their pedagogical knowledge together with their understanding of the local school practices and organizational settings: “The whole age group was in one large group, two teachers, who between themselves, very freely started planning how to do things with that grade, how to divide them into groups, in which subjects etc. … the aim was to start working at the beginning of the autumn term so that each one [pupil in the large group] would have had a personal TabletPC of his/her own.” [Interviewee 1] The exploitation of best practices from pilot projects has also been planned to be develop further by teachers: “Well, this framework is there. This teacher pair continues with this age group and they further elaborate and develop that co-teaching model and the synergy of several teachers. Now we’ll start to emphasize it more in the curriculum, which means that there are two teachers and they have the liberty of arranging the work in class, now we’ll get rid of rigid subject division … We are aiming at this kind of holistic, wider learning.” [Interviewee 1]

The teachers’ participation and more general awareness of the objectives of the future school have been promoted through in-service education. In one of the Smart Schools, weekly meetings with mentors have been arranged to support teachers’ development work: “And every week these teachers of the third-graders at that time plus the teacher-pair, who would start the following year in the same way and these mentor teachers, they were meeting on a weekly basis discussing where we are and what sorts of plans there are, what kinds of partners can be engaged.” [Interviewee 1] In some cases teachers’ resources have been reserved for planning work and also education of their colleagues: “They will take one day to plan something like, depends on how much they need, for three days or as long as a week when they then discuss the fifth and the sixth grades and wishes concerning the upper grades and also the training of the other teaching staff, share the positive experiences about technology use”. [Interviewee 1] Furthermore, teachers of the other Smart Schools have been invited to participate in the arranged planning and training days: “we offer it [training given by the developer teachers] also to other teachers in the future school project so that they could come along and pick from there whatever they wish.” [Interviewee 1]

However, involving teachers would necessitate additional arrangements for their participation, possibly also exposing tensions from the direction of the trade union as explained by the representative of the local educational authority: “We could have a more flexible time plan for teachers, but unfortunately this has not been successful …
the teachers’ union is quite strong and they don’t necessarily always see that even teachers themselves wish the work could be developed.” [Interviewee 4]

Pupils have also been involved as participants in the information infrastructure building for the future school (see also [blinded for review]). As users and learners, the pilot projects have offered possibilities for experiential and collaborative learning in the modernized learning environments supported by ICT solutions: “Cross-curricular projects offer opportunities for experiential and collaborative learning in new learning environments, using ICT.” [Background document] In addition, the pupils have acted as informants and testers (cf. [3]) of the learning technologies. As informants, elected representatives of the schoolchildren have been asked for comments concerning architectural plans and plans for the selection of specific learning technologies in meetings. “Well in these joint meetings when the premises have been planned and put into practice, at regular intervals, the representatives of the student body, representatives of children and of pupils have been present in planning meetings”. [Interviewee 2] Schoolchildren have also participated as testers in user evaluations of the learning technologies produced during the learner-centred product development. Schoolchildren have evaluated a mobile learning environment and a learning game to be developed. “So this kind of usability information, now <mobile environment> is just one example there, another good example of what's been done well is this <learning game>, it was used with fifth-graders, niners and pupils in upper secondary grades. And during that half-hour gaming session one saw that it was meaningful, pupils were smiling, everybody had a good time and stuff had been learnt.” [Interviewee 4]

In addition to children’s participation in ICT development, their participation emerged as a topic in the discourses concerning the school’s role in enabling children’s more genuine participation [5]. The headmaster of the new Integrated Pilot School envisioned school children’s involvement as a subject to be learned along the construction process of the new school: “Then there’s one topic that has kept appearing - engaging children – children and young people in the design of the activities and in starting the activities themselves. We should also have practiced that - in designing this house, for example, and considering the things that should be purchased, furniture, for example, so that is actually what we have sort of practiced and thought about.” [Interviewee 5] There are already structures in the school that enable children’s participation as stressed by the representative of the local educational authority: “We do have well-functioning organizations, student bodies at each school, and there is sort of really favourable ground.” [Interviewee 4] Therefore, children’s genuine participation could be realized by allowing them to take part in constructing their school and planning the activities in there more comprehensively.

6 Concluding Discussion

There is a need to broaden our understanding of participation of various actors in contemporary IS development settings such as in large-scale, longitudinal infrastructure building efforts (e.g. [15], [18], [11]). The results of this study, offering
a fine-grained analysis of participation of various actors in the case of building an information infrastructure for an educational network of a Finnish city, are summarized in table 1. In the results, discourses justifying and characterizing participation of various actors are identified as well as users’ concrete participation practices.

Table 1. Characterizing Broad Participation in Information Infrastructure.

<table>
<thead>
<tr>
<th>Actor</th>
<th>Discourses on challenging and appreciating the installed base</th>
<th>Discourses on equality, continuity, sustainability, cutting-edge solutions</th>
<th>Concrete participatory practices shaping ICT and practices</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Children</strong></td>
<td>Offered motivation to challenge the traditional school – as digital natives</td>
<td>Offered motivation for ensuring continuity and equality</td>
<td>Mainly related to shaping ICT, minor influence</td>
</tr>
<tr>
<td><strong>Teachers</strong></td>
<td>Invited to challenge the traditional school as inevitably relying on the local settings</td>
<td>Needed for ensuring continuity</td>
<td>Developing pedagogical practices</td>
</tr>
<tr>
<td><strong>Headmasters</strong></td>
<td>Invited to challenge the traditional school as inevitably relying on the local settings</td>
<td>Needed for ensuring equality, continuity, sustainability</td>
<td>Developing enabling practices (teachers’ work arrangements)</td>
</tr>
<tr>
<td><strong>Companies</strong></td>
<td>Invited to challenge the traditional school</td>
<td>Needed for ensuring cutting-edge solutions</td>
<td>Providing ICT, experimenting with it in local settings</td>
</tr>
<tr>
<td><strong>Researchers</strong></td>
<td>Invited to challenge the traditional school</td>
<td>Needed for ensuring cutting-edge solutions</td>
<td>Developing pedagogical and enabling practices (teacher education, assessing the impact)</td>
</tr>
<tr>
<td><strong>Educational administration</strong></td>
<td>Invited to challenge the traditional school but also to appreciate the local settings</td>
<td>Needed for ensuring sustainability and equality</td>
<td>Developing enabling practices (funding, inservice education, school-company cooperation etc.)</td>
</tr>
<tr>
<td><strong>Global network</strong></td>
<td>Invited to challenge the traditional school as inevitably relying on the local settings</td>
<td>Needed for ensuring cutting-edge solutions</td>
<td>Providing ICT, developing pedagogical practices</td>
</tr>
</tbody>
</table>

A discourse analysis of participation in this complex case was performed following nexus analysis that extends the research perspective from the micro to the organizational and institutional levels of social analysis. Interestingly, not only the discourse calling for all the actors to challenge the ‘traditional school boat’ but also the discourse emphasizing the appreciation of the local settings and practices of each school emerged. Both can be connected with an acknowledgement of the inescapable effect of the installed base of an information infrastructure [24]. In this case, the installed base was emerging not only in the sense of inertia, but also in a positive
sense relating to preserving and appreciating it (while perfectly in line with the notion of information infrastructure in [24]). Both for challenging the installed base as well as for appreciating it, wide-ranging participation was needed. The same goes with discourses on equality, continuity, sustainability and cutting edge solutions that all contributed to this case involving such a variety of actors. Also a discourse advocating children’s right to participate in matters concerning their life was evident in the data (in line with [5]), even though it had not become fully realized in actual practices yet.

Regarding user participation, teachers and pupils as future users of learning technologies and utilizers of new teaching practices are of particular interest. In the case, no explicit effort of advocating PD or participation related to these two groups of stakeholders was brought up. Nevertheless, the interested teachers in the Smart Schools were given the possibility to develop and experiment with teaching practices; actively contributing to the development in the pedagogical domain, bearing important implications for the (learning) practices of the pupils. The case also reveals that the local educational administration and some headmasters were active in building up new enabling practices that allowed and supported this kind of school-company cooperation and teachers’ development work. The issue of work allocation was also brought up. Teachers are well guarded by their unions that need to be involved in such negotiations. However, there was no particularly wide or systematic teacher participation in this effort, even though some willing and enthusiastic teachers from some Smart Schools have taken part. Moreover, also pupils were invited to take part in the information infrastructure building, even if their participation mainly concerned some ICT solutions under development. They were primarily seen as users, informants and testers (cf. [3]) providing feedback on some specific ICT solutions. On the other hand, some adults in the case brought up that children should be involved more comprehensively, and their more genuine participation (cf. [5]) should be supported. This is a positive observation even though no concrete actions were reported alongside the future visions.

The concept of information infrastructure [24] enabled us to describe the case in its richness; in this case especially the notions of reach of infrastructures, the inevitable intertwining of practices and technology, and the inescapable effects of the installed base. ‘Challenging the traditional school’ required renewal of the technological equipment and practices intertwined, while the educational development projects and adoption of learning technologies were based on the installed base of each school. In the adaptation work to local settings the importance of the local actor’s knowledge was emphasized. Appreciating the installed base contributed to broad inclusion of schools. Also broadening the spatial and temporal reach of the information infrastructure was a continuous concern in the effort that required broad participation of various kinds of experts, the schools and children. The solutions built in the pilot schools should extend to other schools in the city-level network and preferably even further on the national and international level. The technological development with orientation to the future and for acquiring the cutting edge solutions, furthermore, connected the school participants, educational authorities and project managers with a global network. During local development efforts, the experimentation of new pedagogical practices was entwined with the new learning technologies at schools. Teachers had a major role in developing the new pedagogical
practices intertwined with the new technology, while also pupils took part as informants or testers. In this kind of information infrastructure building cases there likely is a variety of actors – users and other stakeholders – participating, for various kinds of reasons as the discourses identified indicate.

We have described a real-life infrastructuring process for the future school and increased the existing understanding of participation ‘in the wild’. As our empirical data shows, various kinds of actors participated, including some users. Our data shows the value of enabling practices supporting participation, training as well as the use of special support groups. Especially with the ‘invisible’ information infrastructures it is a challenge to arrive at shared understandings and to articulate the results and potential solutions in accessible ways (cf. [18]). New practices are also needed for better integrating the local and situated subprojects within the overall social network of longitudinal, infrastructure building efforts. Supporting potential participants is closely linked to another emerging issue from the data, namely the question of selecting suitable representatives. Based on our data we would like to highlight the current obscurity related to this representation. It seems that only by their formal position, certain actors were expected to represent others, even without a legitimate authorization (e.g. teachers representing pupils, headmasters representing teachers, etc.). We highlight the importance of understanding the organizational and social context in which the participatory infrastructuring is conducted (in line with [11]).

For studying an information infrastructure building effort with a variety of actors, even more material could be gathered. The research framework of nexus analysis provided us a lens for examining the phenomenon from a variety of perspectives, also on macro level. Still, a more detailed look on the dimensions of social action and the discourses as part of it would be needed to gain a better picture of the dynamics and intricate arrangements of relationships. Furthermore, our interventions connected with changing the nexus of practice, an integral part of nexus analysis, are yet to be reported.

References


Development of the Virtual Learning Environment for the Differentiated Instruction of Mathematics in the Comprehensive School

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Abstract. During the last few years the Finnish students’ skills in mathematics have been declining, and the teachers have utilized the information and communication technology a little. In addition, the reform of the strategy of special education in comprehensive school in Finland in 2007 has increased the need for differentiated instruction. Scientifically, it is interesting, whether information technology (IT) could help to differentiate instruction and could IT offer opportunities not yet tested in practice. We therefore ask: Can we build the IT-system, which allows to differentiate instruction in mathematics in comprehensive schools? In this article, we describe such kind of the virtual learning environment. We used action research in the development and we describe the development process, which has lasted seven years, this far. The built IT artifact seems to satisfy the requirements of differentiated instruction. Teachers now use the system consistently, and it demonstrates that we found a successful solution to our problem. We present principles to construct a learning environment for differentiated instruction.

Keywords: differentiated instruction, mathematics, virtual learning environment

1 Introduction

We study the differentiated instruction (DI) of the mathematics of the higher classes of the Finnish comprehensive school with the help of information technology and communication technique. Finland’s excellent results in the PISA studies have been declining [1], in national studies the learning results have also been declining [2,3] and in the utilising of the information technology in the teaching, the Finns have regressed measuring internationally. Especially the teachers of the mathematics have utilised little information technology [4]. Based on these facts and based on the subjective development needs of the teaching I and my colleague Sauli Hartikainen began to develop a virtual learning environment for the teaching of the mathematics in 2006. The Ministry of Education renewed the strategy of the special education in comprehensive school in 2007 [5]. The reform was executed as a change of the law in 2010 [6], which increased the need for the differentiating of the instruction further. In
this strategy, all the pupils belong to the group of the general teaching. This form of
the integration is called inclusion. The principle of the inclusion is that all the pupils
go to school together, the common teaching for the pupils has been arranged
according to individual preconditions and every pupil and member of the staff knows
that he is accepted and appreciated in the school community [5]. The differentiated
instruction (DI) is needed to carry out inclusion. DI is defined as a process, where the
potential and the abilities of the different pupils are made to get out and to develop in
the same class without compelling the pupils to adapt to a curriculum [7, 8].
According to Tomlinson [9], there is a question about both of the teaching philosophy
and of the ordinary methods in the differentiated instruction.

Rock et al. [10] and McQuarrie et al. [11] stated that the pupils, who had suffered
about the learning difficulties, benefited more from the differentiating instruction than
the pupils who usually got through. Tieso [12] has noticed that the differentiated
instruction has offered challenges, which promoted the learning of the gifted pupils in
the lessons of the mathematics. Differentiated instruction, which enabled the pupils to
proceed on their own tempo and where the pupils got regular estimates from their
working, led to the bigger effectiveness [13]. The self-assessment and the supporting
the own responsibility were considered important. Tomlinson et al. [14] have noticed
that the differentiating of the instruction is scattered and random in practice even
though the teachers want to do it. Li and Ma [15] have perceived in their meta-study
that in the use of the computers in the teaching of the mathematics there have been
obtained better learning results than without the computers. The systematic literature
review without gaps has not yet been performed but according to the wide review that
has been executed the similar study has not been found.

A need for the differentiated instruction of the mathematics appears in practice.
The scientific study has been minor from the differentiated instruction of the
mathematics utilising information technology. We ask for the previous: “Can we
build the IT-system, which allows the differentiated instruction in mathematics in
comprehensive schools?” The sub questions in detail are: “Does the information
technology promote differentiation? Can instruction be differentiated with the help of
the information technology in the way which has not been tried earlier?”

The objective has been to develop the artifact to solve the practical problem. We
therefore examine the research problem from the frame of reference, which has been
created by March and Smith [16] and developed by Hevner et al. [17]. In the frame of
reference, there are two halves: solving of the practical problem and evaluation of the
implementation. Vaishnavi and Kuechler have gone on the thinking of the problem of
the design science research (DSR) in the Internet [18]. Peffers et al. [19] state that the
development of the design science research as a method of the IT study is minor.
According to them, the numerous studies have been carried out from the point of view
of the design science research without realising. Järvinen [20] compresses the
researcher's action to solve the practical problem and to get scientifically interesting
information. The action research is this kind of research method, which is very much
similar to design science research [21]. We use a canonical action research [22] for
the description of the developing of the artifact where diagnosing, action planning,
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action taking, evaluating and specifying learning are repeated as several loops according to a cyclic process defined by Susman and Evered [23].

We have adapted Mathiasenin et al. [24] recommendation in the reporting of the action research. The research place and the study environment are described in the second section. In the third section, the long study process is described cycle by cycle. The description has been presented at a rather abstract level for the sake of the limited length of the article. The fourth section contains the lessons learned during the process. In the fifth section it is shown that the artifact fulfills the demands of the differentiation of the instruction. The presentation of the results, the reflection and the suggestions for further research are included in the sixth section called discussion.

2 Description of the Research Place and of the Study Environment

The coeducational school of Orivesi has served as a primary study environment for seven years. In this comprehensive school, in which there are over three hundred pupils, higher classes (7th-9th) are taught. My colleague Sauli Hartikainen and I have been responsible for the designing and carrying out of the project. We have done the developing of the system in addition to our own profession as teachers. It has to be seen as a process of our own voluntary vocational lifelong learning. The project money has made short full-time periods of development possible. The cooperation with the University of Tampere began when I remained in the autumn of 2010 for two years to the study leave. As its consequence, we have got student resources from university during three school years for the building the learning environment. With the help of the project money, we have also been able to get graphics and graphic design. We began to partially use the learning environment immediately since the autumn term in 2006. When we were able to use the computer class since the autumn term 2009, we began to use the learning environment in the teaching full-time. By the year 2013 the number of the teaching groups has increased to eight. The number of the computers has restricted the use of the learning environment.

3 Description of the Study Process in Chronological Order

The developing of the learning environment during the years 2006 –2013 is described as seven school year long cycles in this section. The cycles are described as rounds of five different stages using Susman's and Evered's model [23]. The first cycle is described in the subsection 3.1 and the latest, in other words seventh, in the subsection 3.7. Cycles from the second to the sixth are described in the subsections which stay in-between.

Susman and Evered define the cycle of action research having five phases: diagnosing, action planning, action taking, evaluating and specifying learning. Diagnosing means identifying or defining a problem, action planning means considering the alternative courses of action for solving a problem, action taking
means selecting a course of action, evaluating signifies studying the consequences of an action and specifying learning signifies identifying general findings.

The first four cycles of the study process were stages in which case I implemented the system myself. In the rest three cycles the programming work has been done in the project work course of the University of Tampere while I and my colleague have been clients. However, when I studied software engineering at the University of Tampere for two years, I acted in the first project in the project worker's and customer's double role and in another project in the project manager's and the customer's double role. The project group has changed every year. The transition of the implicit information has been helped that at least one person as a project worker has continued in the following project as a project manager. The phases defined by Susman and Evered [23] appear more clearly in the latest cycles than in the earlier ones because of the project work courses. Scrum has been applied as a software development model and the software architecture started to base on MVC design pattern in the project work courses. Before the project work courses my programming did not follow any software development model nor design pattern. It can be described as the piloting programming of functionalities without clear aims for the filling of qualitative demands.

It should be mentioned that the artifact under development has been used beginning from the first cycle in the teaching. The evaluation is based on the experiences received by us in our own job as teachers. In our action research, we have both developed the system and acted as a teacher using the learning environment, which we have developed ourselves. Coghlan [25] and Lallé [26] have shown that the researcher can have a double role both as a researcher and as a worker (manager) of the organization. Thus, we can use our own experiences as teachers to evaluate the artifact justifiably. Later our two colleagues from the coeducational school of Orivesi have begun to use the learning environment in their teaching. In addition, teachers from the separate sites of Finland started to use the system during the time of the latest cycle, of the school year 2012-2013. This might correspond to the definition of the action research by Carr and Kemmis [27]. According to that definition while the action research project progresses the more people bind themselves for the improvement of practices.

3.1 The First Cycle: Spring 2006 and the School Year 2006-2007

Diagnosing

Based on a text book teaching and its non-satisfactory effectiveness I was depressed. The idea to utilize information technology and communication technique (ICT) had stewed already long in my mind. I find a note in my diary 12th August 2003: "Developing of the network teaching." When I with my colleague in the winter 2006 became conscious on the similar willingness to develop, we started to discover the utilizing opportunities of ICT in the teaching.
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Action Planning

We started to design a virtual learning environment supposing that the human being is a self-steering system [28]. We try to use the teaching method where the studying would be led by the pupil herself or himself as much as possible and the learning environment would support this. We recorded preliminary specifications of the system in our project plan in April 2006.

We had three alternatives: 1) to start to develop the system drawing up ourselves and to take it into use or 2) to start to adapt a ready virtual learning environment as Moodle and to take it into use or 3) to continue the designing of the system without bringing it not yet into use.

Action Taking

We decided to start to develop the learning environment ourselves because we had some skills to implement the system. Furthermore, we wanted to learn drawing up of Web pages. We argued doing ourselves with the fact that with increased experiences and skills, we could carry out such features in the system just that we wanted. We implemented the website using HTML, PHP programming and the MySQL database. The choice of tools was based on the recommendation of my friend who knew programming better than I. He also helped with PHP and database in the getting to run at the beginning. The site was invested in a website hotel and with domain name matematiikka.net. We used the learning environment with the teaching groups especially assigned to us and under our control.

Evaluating

The pupils' spontaneous theory studying did not succeed.

The first version of our system acted as the learning environment but it could not be utilized in the studying in the way we wished. The use of computers was not possible the whole time. For more than three hundred pupil there was only one functioning computer class in the school.

Specifying learning

The theory of mathematics must be taught in one way or another.

3.2 The Second Cycle: Autumn Term 2007

Diagnosing
In the previous term, the inability or unwillingness of the pupils to find out themselves the theory of mathematics was observed a problem. In order to go forward in the utilizing of the network, the studying with it should become regular. With the computer resources of the school it was not possible.

**Action Planning**

We changed our thinking towards the theory teaching in such a way that it would be given to the pupils in one way or another. In order to achieve the use of the network environment to become regular, we decided to require the pupils to check of assignments and to mark of training results to the learning environment at home. We would like to mention such a detail, that we were planning to implement the feature, which trains the learning of the multiplication table.

This year we were the corresponding teachers for the learning groups of the seventh grade. We were considering the use of the learning environment with those groups. The second alternative was to continue with the groups of ninth grade.

**Action Taking**

We continued with the teaching groups of ninth grade, because we had ready-made contents for ninth grade but not for seventh one in the learning environment. The home working was carried out. First it was made sure from the guardian (parents), that it was opt for the pupils to use the Internet at home. We began to draw up educational videos in the course of the autumn. They were given to the pupils in DVD. A function which practises the multiplication table was implemented as an individual feature.

**Evaluating**

According to the pupils as well as the guardian (parents), the obligatory home working proved to be too loaded. At the end of the autumn term it was drifted to the situation that the use of the learning environment was given up for the rest of the school year. The situation was critical. Especially my colleague received such a feedback from a few supporters that was knocking out. His situation went worse, because he punctually wanted to check trainings and their evaluation in the network at home.

My colleague's wife used the system to practice the multiplication table in the remedial teaching of the lower classes of the comprehensive school successfully.

We received affirmative feedback about the educational videos from the pupils. We did not distribute videos at YouTube at that time yet. That was, because I considered that channel was inappropriate for pupils on those days.

**Specifying learning**
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Home working in learning environment cannot be demanded, or it must not at least load a pupil more than obligatory working without the system.

It is worth placing the renewing of working methods when the pupils change the school.

It was learned from the practicing of the multiplication table, that the practice can be motivating even if the user interface had a modest appearance and functionally. The immediate feedback and opportunity to get better results rapidly were the most important.

3.3 The Third Cycle: the Spring Term 2007 and the School Year 2008-2009

Diagnosing

The pupils and their teachers experienced, that the working in the network at home was too binding and it had to be given up. The problem arose from this because there were no necessary devices at school.

Action Planning

There were two alternatives: to give up the use of the system or to continue with those resources which were available.

Action Taking

We decided to continue with the limited resources and we used the learning environment in the teaching of the groups of the seventh grade.

Evaluating

The termination of the previous iteration to the crisis might have discouraged our motivation but two points encouraged us. First of all the Finnish National Board of Education provided the support for the developing of the learning environment for two years. Second we met Mrs Tarja Korhonen, a lecturer from the city of Kouvola. And she used the learning environment during the time of the spring of 2007 getting mainly affirmative feedback from the pupils. This cycle, which lasted one and a half year, was the most modest stage from the point of view of the developing of the system even though it was the first block where we got pecuniary support to the work.

Specifying learning

The workmate gave power to continue.
The public support was important to us even though it was fairly small. The support made the participation in the educations possible and it was possible to cover material expenses. The fact that our work was appreciated may have been even more important.

It was worth offering a learning environment into use of other teacher. We received positive feedback and some more experiences.

3.4 The Forth Cycle: the School Year 2009-2010

Diagnosing

There were a lot of ideas and plans but the own skills and time seemed to be too limited.

Action Planning

Our colleagues and my friend encouraged us to clarify whether it would be possible to get the learning environment as the student project of the Tampere University of Technology. Another alternative was to continue with our own resources.

The possibilities to use of the learning environment in the teaching improved significantly at school when we got the possibility to use the computer class full-timely with two teaching groups. We had to choose whether we continued with the groups, which started to use learning environment previous year (8th grade), or should we start with the groups, which just begin in the new school (7th grade).

Action Taking

It happened that our project was not chosen as the project work in Tampere University of Technology. There was a lot of project work available. The students were not interested in our subject. So we continued with our own resources. At this stage, we had carried out user management and a user interface utilising MediaWiki. I implemented the features of the learning environment connected with MediaWiki. We began the use of the learning environment with the pupils who have just changed the school, because we had earlier learnt that it will be easier to start new procedures with the pupils, who change the school.

Evaluating

This cycle was epoch-making. For the first time we began to use the learning environment so that the teaching with the learning environment was continued with the same teaching groups until the end of the comprehensive school.
In the spring of 2010, I decided to begin studies in computer sciences in the University of Tampere since the following autumn. I experienced an educational work and simultaneous developing heavy. Furthermore, I wanted to improve my skills of software engineering.

**Specifying learning**

Even though the port of the technical university closed, a new port opened with my studies.

### 3.5 The Fifth Cycle: the School Year 2010-2011

**Diagnosing**

So far, I had not followed any software architecture when I had implemented an information system and its security was bad. I became conscious of these in the project work course in the university.

**Action Planning**

The system made by me served as the example. The task of the project team was to draw up the system following good programming style and having security. We had to choose a suitable software framework. The alternatives were, Joomla, CakePHP and CodeIgniter among others. They supported the MVC planning model.

**Action Taking**

We chose the CakePHP software framework eventually.

**Evaluating**

The new information processing system was brought into use in April. The old system was totally rejected, even the database was not saved. The access control of the learning environment remained unfinished. The user interface remained modest, because the developer of the interface went abroad during the project. In any case, we were able to produce a considerably better system, especially qualitatively.

**Specifying learning**
The studying is worthwhile. Other studies besides the project work course were useful from the point of view of the developing of the learning environment. The information technology know-how does not guarantee an ability to think of what is significant and important pedagogically. I noticed the importance of my teaching experience.

3.6 The Sixth Cycle: the School Year 2011-2012

Diagnosing

The access control had remained unfinished. Because of this the information security of the system was threatened. The user interface and the appearance were modest reducing the interest to use the system.

Action Planning

We hoped that the new project team would continue work.

Action Taking

The leader of the project work course accepted the subject and the developing continued. I operate in the project group in the project manager's and the customer's double role myself. We corrected the access control. We bought graphics and graphic design because we had project money. This way we made the appearance of the system to be more taken.

Evaluating

The second successful project by students strengthened the idea that the development work was worth continuing as student work. In his study, Topi Anjala noticed that the attitudes of the pupils who study on the learning environment were more positive than those of the pupils of control groups. The instability of the site appeared soon after the updating of the system. The second negative point was that the Geogebra applets that were used in the system, did not function.

Specifying learning
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The appearance has significance. When we demonstrated the system which had got a new appearance to the persons who knew the system before, they were excited about the reform.

3.7 The Seventh Cycle: the School Year 2012-2013

Diagnosing

The previous updating caused the instability. It was uncovered that the reason was in the drills which I had carried out ineffectively. Because of the information security problems of Java the Java support was removed from a pupil network. Thus the Geogebra applets did not function any more. The automatic controlling of the studying and the giving of the feedback still did not fill our wishes. The reports received by the teacher were unfinished still.

Action Planning

Again, we hoped that the new project team would continue work.

Action Taking

The third project work in the university came true. At the moment of the writing of this article, we are waiting for the updating, where it will be reacted to all the drawbacks mentioned before. The project team proposed the updating of the CakePHP software framework from version 1.3 to version 2.0. We accepted the proposal.

Evaluating

The teachers have begun to use the learning environment around Finland even though the learning environment has not still been actively marketed. The teachers who are interested in the use have made the connection by e-mail in order to ask for the teacher's rights to their account. Many teachers are from the school where another teacher has used the system already earlier. We consider this snowball effect affirmative.

Topi Anjala [29] studied the pupils' view on mathematics. The results were more affirmative in all the variables in the groups who used the learning environment than in the control groups. The material had been collected during the previous cycle. The maintenance of the virtual server and the background software - e.g. Apache, MySQL, PHP - requires special know-how.
Specifying learning

The maintenance of the system is worth outsourcing so that we can concentrate on the essential.

4 Lessons learned

In this section, we list the planning principles for the developing of the learning environment for the differentiated instruction in the comprehensive school. These principles appeared in the phases of “Specifying learning” in Susman and Evered -cycles [23]. Schön [30] has studied this kind of reflecting of the employer's own working methods in order to improve them.

1. The theory must be taught in one or another way (Sub section (Ss) 3.1).
2. A pupil cannot be required to use the information processing system at home. At least, it must not load a pupil any more than working without the system (Ss 3.2).
3. It is worth placing the changing of the working methods when the pupils change their school (Ss 3.2).
4. In the features to practice the routines, like the multiplication table, the immediate feedback and possibility to improve fast the results are the most important things. Even the modest user interface and appearance are not restricting factors (Ss 3.2).
5. When the difficulties arise in the development work, the workmate is more important. This showed up when the parents resisted the use of the system and we had to give up for the rest of the season (Ss 3.3).
6. The relatively small external support can encourage when the motivated teachers develop the system in order to improve teaching. The first support which we got from the Finnish National Board of Education was quite small. The fact that our work was appreciated was important to us (Ss 3.3).
7. The system which seems modest and unfinished is worth giving an outsider to be tested (Ss 3.3).
8. When one door closes, another can open is true in developing too. Our work was not accepted in the Tampere University of Technology 2009, but next year I started my studies in the University of Tampere and our work was accepted as a project work there (Ss 3.4).
9. Having the information technology know-how does not guarantee person's ability to understand what is significant and important pedagogically. The pedagogic know-how is necessary in the planning of the information processing system that has been meant for studying. This finding we have found in each project work in the University of Tampere (Ss 3.5, Ss 3.6, Ss 3.7).
10. The appearance of the system has significance when the support is asked for development (Ss 3.6).
11. The maintenance of the system is worth outsourcing so that the people responsible for the planning can concentrate on work more essential one (Ss 3.7).
5 How Does the Artifact Meet the Requirements of the Differentiation

Tomlinson et al. [14] have defined the requirements of the differentiation by marking off what the differentiation is not and what it is and by giving a more exact explanation. In the following list some requirements are examined from the point of view of the learning environment (math.fi):

1. **It is not:** Just for students with labels. **It is:** For every student. *Explanation:* Every student has particular interests and learning preferences as well as a readiness level that varies over time and situation. Each learner needs appropriate support. *Math.fi:* Every pupil practices his own individual tasks in his own rhythm.

2. **It is not:** Something extra in the curriculum. **It is:** At the core of effective planning. *Explanation:* Differentiation is not something you do when the real lesson is finished. It's integral to the whole taught and it tries to guarantee that each student has a path to success with key content goals. *Math.fi:* The learning environment is particularly for this purpose.

3. **It is not:** Tracking in the regular classroom. **It is:** The antithesis of tracking. *Explanation:* Effective differentiation requires use of flexible grouping patterns so that students consistently work in a variety of groups based on readiness, interest, learning preference, random assignment, teacher choice, and student choice. *Math.fi:* The working is based on the pupil's choices which are supported by the automatic supervision and feedback system that has been built in the information processing system. Also a spontaneous peer support seemed to show up as functioning.

4. **It is not:** Synonymous with student choice. **It is:** A balance between teacher choice and student choice. *Explanation:* There are times when it's important for teachers to assign particular works to students because it will move them forward in the key direction. Otherwise, it makes good sense for students to call the shots and learn about making wise choices. *Math.fi:* The pupil makes her or his own choices in the learning environment. However, the automatic feedback given by the learning environment is directing the pupil into the essential direction. The teacher can intervene in the pupil's action when seeing in real time what kind of notes the pupil records into a system.

5. **It is not:** Individualization. **It is:** Focused on individuals, small groups, and the class as a whole. *Explanation:* Although an aim of differentiation is to focus on individuals, it is not a goal to make individual lesson plans for each student. *Math.fi:* In this, we disagree with because in our opinion, it is meaningful in the mathematics that the pupil practices tasks suitable particularly for her or him at each moment.

The learning environment fulfills the criteria of the differentiated instruction according to Tomlinson et al. [14].
6 Discussion

The quality of the action research is measured with its usefulness [16, 17]. The usefulness is shown with four indicators. First of all, the learning environment fulfills the criteria of the differentiated instruction according to Tomlinson et al. [14]. Second, my own use and my desire to develop the system support its usefulness. Third, several teachers have begun to use the system during the last year and their desire to use the system demonstrate its usefulness. Fourth, affirmative feedback that has been received from the pupils and Anjala’s [29] studies about the pupils’ positive view on mathematics show that the system is useful. Furthermore, the knowledge has been produced for the developing and use of the system. It was described in Section 4.

After different stages we have proved to be possible to build the artifact which supports the differentiation of the instruction and is already widely in use. According to Gregor and Hevner [31] the acquired contribution can be classified to level two. Gregor and Hevner talk about the design science research (DSR). However, we invoke to the study of Järvinen [21] where he shows that action research is similar to DSR.

In the future, a more comprehensive literature review has to be made. Second, a study on the effectiveness is needed even if the system were considered useful [16, 17]. Measurement of effectiveness in learning must be conducted as a controlled experiment concerning both the teachers and the pupils. The third subject of the further study is a theory from the human being as a self-steering system [28] which will get implicit support when the pupils accept a system built on the basis of that theory. Finally, it is necessary also to specify the method of the action research in which the actor of the organisation is a researcher himself [24, 25].

7 References

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Exploring the concept of architecture in Technology and Organization studies

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Abstract. In this paper we explore the use of the concept of architecture in Technology and Organization studies. We identify three discourses on architectures: one concerned with relationships among technical objects, one extended to cover sociotechnical relationships, and one where architectures themselves are the object of study (a discourse where there is an explicit strategic interest on the effect of architectures). Finally, we trace how different conceptualizations relate to different concerns related to change.

Keywords: Architecture, software, enterprise architecture, communication, control, complexity

1 Introduction

The notion of architecture conveys the idea that a set of elements are clustered into forms that are more or less stable and relate among themselves following a predefined logic. When thinking processes of change, “architectures” are frequently objectified as enabling or constraining factors: some architectures are viewed as better than others for accommodating change (robust architectures) or even for prompting change (generative architectures). However, the concept of “architecture” is considered by many researchers as ill-defined. For instance, Scheil (2008) describes architecture as being “a plastic concept ... a metaphorical idea that shapes the categories, discourse and language used” [1]; Smolander et al (2008) identify multiple metaphors that describe different meanings of architecture as perceived by various actors, who participate in the creation and use of software, and they argue that “Architecture, thus serves as a shared boundary object (Star, 1989: Star & Griesemer, 1989; Bowker & Star, 1999) between various stakeholder groups engaged in systems development, satisfying their varying informational needs during the systems development process”[2]; similarly, Bidan et al (2012) stress how: "The notion of an architecture is problematic in part because it seems to be usefully ambiguous and is often used at a high level of abstraction where anyone can agree that it is a useful concept" [3].

Although conceptually elusive, architectures are central when discussing processes of stability and change. For example, the US National Research Council in a recent report argued: “organizations should architect healthcare IT for flexibility to support disruptive change rather than to optimize today’s ideas about healthcare” (Committee on Engaging the Computer Science Research Community in Health Care
Informatics 2009). And, in the much sited book of Cummings and Worely on Organizational Development and Change [4] it is claimed that interventions need to address “the organization’s architecture” (when discussing interventions that transform the way organizations relate to its environment or operate internally).

The aim of this paper is to explore the conceptualization of ‘architecture’ in technology and organization studies and to trace how different conceptualizations relate to different concerns related to change. Therefore we ask: how is architecture conceptualized and how it relates to change in technology and organization studies? By identifying and expressing the differences in the content of the word architecture and by tying these differences to distinct change concerns, we hope to contribute a sharper understanding of a notion that remains ambiguous although extensively used.

The paper is structured in the following way. First, we present our method. Then, we provide a brief overview of how the term architecture has been used in the literature we examined. More precisely, we identify three discourses on architecture: one concerned with relationships among technical objects, one extended to cover sociotechnical relationships, and one where architectures themselves are the object of study (a discourse where there is an explicit strategic interest on the effect of architectures). Finally, in the discussion section we point to the different roles of architecture in the three discourses.

2 Method

In order to investigate the use of the concept of architecture in technology and organization studies we have conducted a search in google scholar with the keyword architecture, information system, organization, technology. We have then ordered the search results according to their citation index. In the review we focus on how authors have conceptualized architecture, and how the term was used in the text for instance in association with other key terms. We have started grouping publications into two main categories, one dealing with technical issues of architectures, and one dealing with architecture in the context of enterprise and business models. These two ways of using the term architecture covered the majority of the studies. However, we also considered studies that come from literature thematising strategy, innovation and organizational change. While these studies may not strictly deal with implementation of technologies, we found they opened up a different discourse on architecture than the ones proposed by technical and business models studies. We labeled these studies ‘strategic approaches’. We have then further elaborated the profile of the three conceptualizations and identified the most cited work (classics) within each.

Our subsequent analysis of the collected material is informed by a meta-level discussion on the use of the concept of architecture as a communication tool. For instance, much of the literature on software architecture we have reported has discussed issues of multiple views, problems of communication between stakeholders, and the lack of one ‘single’ understanding of architecture in software projects due to ‘multiplicity of structures’. Such discussions seem to point to a function of architecture as ‘boundary object’ [5] among different communities. As Bass et al. claim, an architecture is a set of structures to reason about a system [6], however such
reasoning is a collective endeavor of an heterogeneous community. Accordingly, Smolander et al claim that research on software architecture may benefit from the work in fields such as CSCW where the topic of reconciling different views is discussed, and the concept of boundary object is one of the core concepts of the research field [2]. Gorton [7] stresses how the architecture is an abstract description of the system that “has to” employ abstractions in order to be understandable by the team members and project stakeholders. Abstractions allow to black box components in order to focus on their external properties, and allow flexibility in composition and decomposition work. Similarly, boundary objects are organic infrastructures that arise due to the ‘information and work requirements’ of the group cooperating [8].

A similar point is raised by Scheil when he argues that IT architecturing is a learning process as “one or more meaningful interpretations of the continuous organizing, emerging from the interrelationships between a sociotechnical system’s parts” [1]. Here, the emphasis of architecture/ing is not on the relationships between various parts of a larger system, but on the human interpretation and understanding of these relationships (a sense making process with reference to [9]). Further Scheil argues that this view recognizes technology as “intentional and subjective in its nature, and not an objective instrument, where the tangible use determines its position” [1]. He sees architecturing as indicating the necessary role that humans play when mediating between various architectural semantics such as business architecture, and software architecture.

In the line with this meta-level discussion, we have approached the reviewed literature on architecture with attention to how the concept of architecture identified in the three profiles conveys the understanding of change.

3 A Technical View: Components and their Interrelations

The common understanding of ‘software architecture’ is that of structure describing systems’ components, their operational principles and their interconnections. An example is the classic definition given by Bass et al. (1998): “The software architecture of a program or computer system is the structure or structures of the system, which comprise software components, the externally visible properties of those components, and the relationships among them”[10]. In this understanding the term architecture has a structural and technical connotation and indicates the components of a system and their arrangement. The basic syntactic elements of an architectural description are components, connectors, and configurations of components and connectors. Components are the active, computational entities of a system that accomplish tasks through internal computation and external communication with the rest of the system via a collection of interaction points defined as ports. Connectors define the interaction between components and each connector provides a way for a collection of ports to come into contact in addition to defining the protocol through which a set of components will interact. A configuration is a collection of component instances which interact by means of connector instances [11].
In a more recent work, Bass et al define software architecture as “the set of structures needed to reason about the system, which comprises software elements, relations among them, and properties of both” [6]. It follows that software systems are composed by many structures, and no single structure is the architecture of the system. It also follows that a structure is architectural if it supports reasoning about the system and the system’s properties.

A main problem discussed in software architecture literature is that of architectural representations. In one of the classic works, Zachman (1987) is concerned with developing awareness on the use of representations of software architecture for improving professional communication among owners, designers, and builders in the process of building complex information systems[12]. He shows how in this process a variety of representations are created at different levels of detail, are different in nature, content and semantics, forming a set of multiple architectural representations depending on different roles, as illustrated in figure 1.

<table>
<thead>
<tr>
<th>If you are:</th>
<th>Then you probably think architecture is:</th>
</tr>
</thead>
<tbody>
<tr>
<td>A programmer, The database</td>
<td>A structure chart</td>
</tr>
<tr>
<td>administrator, An analyst</td>
<td>Data design</td>
</tr>
<tr>
<td>A planner, The communications</td>
<td>A data flow diagram</td>
</tr>
<tr>
<td>manager, An operations manager</td>
<td>The business logistics infrastructure and/or the</td>
</tr>
<tr>
<td></td>
<td>distributed systems architecture</td>
</tr>
<tr>
<td>A network administrator</td>
<td>The system architecture</td>
</tr>
<tr>
<td>A program support representative</td>
<td>Detailed data and program descriptions</td>
</tr>
<tr>
<td>A computer designer</td>
<td>Machine language (not represented on the summary</td>
</tr>
<tr>
<td></td>
<td>chart, Figure 2)</td>
</tr>
<tr>
<td>The president</td>
<td>Entity classes, process classes and/or a map</td>
</tr>
</tbody>
</table>

Figure 1: Different architectural representations for different roles [12]

Another classic work is the one by Kruchten on architecture views [13]: he identifies a way of describing an architecture based on four views: logical, process, physical, development views. These views describe the system from different perspectives according to different users’ needs, and a ‘scenario’ view overlaps the others and relates the design to its context. These views represent different stakeholders’ interests as a set of coherent, logical, harmonized descriptions. However, the discussion in the field has been directed mainly at representing and documenting a system’s architecture from different perspectives without really offering a detailed description of the rationale that guides the architecting process [14]. For instance, Smolander et al (2008) argue for broadening the focus of current approaches to representing, designing and communicating software architectures in a
way to support the role that different stakeholders play in the creation and use of software architecture [2]. Based on a study on three-software producing organizations, they have focused on understanding how the different stakeholders generate, represent, use and share knowledge regarding software architectures. Their findings stress the coexistence of different views on software architecture, and recognize the need for addressing the communication needs of stakeholders. Bosch (2004) argues that one of the key challenges of the software architecture community has been that software architectures need to be designed carefully because changes after the initial design are typically very costly. Software architectures change independent of how carefully they are designed. Thus, he argues that “Rather than components and connectors, we need to model and represent a software architecture as the composition a set of architectural design decisions, concerning, among others, the domain models, architectural solutions, variation points, features and usage scenarios that are needed to satisfy the requirements”[15]. Thus, software architectures should be represented in several phases of the lifecycle. Finally he redefines software architecture as the composition of architectural design decisions, and not a set of components and connectors (Idem).

4 Extended Conceptualizations: Enterprise Architectures

Going beyond the technical focus, the architecture notion has also been used to map holistically relationships among heterogeneous components that together constitute purposeful work systems. The term “enterprise or business architecture” has been used to encompass sociotechnical arrangements of software, hardware, organizational structures, human competences and incentive schemes, [16-19]. These architectures address enterprise-level objectives like efficiency and effectiveness and mirror managerial choices for the desired level of standardization and integration within large scale work systems: “The enterprise architecture is the organizing logic for business process and IT capabilities reflecting the integration and standardization requirements of the firm’s operating model”[19].

The use of architectural maps to associate diverse components of complex work-oriented sociotechnical arrangements is not new. The increasing complexity of work settings has triggered the development of numerous reference models and design frameworks for sociotechnical architectures during the last 30 years (see figure 2). These are either industry specific like: "Computer Integrated Manufacturing Open System Architecture- CIMOSA" (aims to support the enterprise integration of machines, computers and people in computer integrated manufacturing settings) and, “Purdue Enterprise Reference Architecture-PERA” (provides a consolidated view of production facilities, people/organization, and information systems) or generic such as GERAM (Generalized Enterprise Reference Architecture and Methodology), ARIS (Architecture of Integrated Information Systems) that covers process design, management, work flow, and application processing, or TOGAF (The Open Group Architecture Framework) that aims to encompass simultaneously: business strategy, governance, organisation, processes, data structures, applications, hardware capabilities and standards [20-25]. All these architectural models and frameworks
support the figurative definition of relationships but at the same time they aim to serve as control tools. They aim to put in place specific rigid regulatory setups that will guide the development of novelty into specific directions. Following this fully planning ideal, the role of the “architect” within specific project teams is then stripped from ingenuity and resourcefulness connotations and is reduced to a role similar to the one that compliance officers have. In their book “Enterprise Architecture as Strategy”, Ross, Weill and Robertson write: “project architects are responsible for ensuring that individual projects are compliant with technology standards and that related projects reuse technologies as appropriate. If a project architect feels an exception to the standards is warranted, he or she either seeks approval from one of the assistant vice presidents authorized to grant exceptions or refers the request to the architecture committee” [19]. Segars and Grover 1994 argue: “unlike bottom up approaches which typically emphasise the information needs of traditional functional areas, the architecture approach is ‘top down’ in nature” [26].

![Diagram of different frameworks for enterprise architectures](image)

**Figure 2**: Schematic of different frameworks for enterprise architectures

Today, within informatics there is a lot of discussion on “ecosystems” within which different technical components evolve following trajectories that are not dictated by traditional hierarchies and are not mere instantiations of fully pre-planned courses [27-29]. To cater for this new situation, a recent Gartner report puts forward the new concept of panarchitecture: “Network-centric and biologically based dynamic models are needed in order to design solutions, enterprises and industries that are more resilient in the face of transformative change, especially unforeseen transformations. Such models include "panarchy" from ecological science, "hyperconnected networks" from network science and "relationship coordination"
from organizational science. These emerging models will be integrated using hybrid thinking to complement enterprise architecture with a new paradigm of renewal known as panarchitecture". [30]

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
<th>Reference/Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software architecture</td>
<td>The fundamental organization of a system embodied in its components, their relationships to each other, and to the environment, and the principles guiding its design and evolution.</td>
<td>ISO/IEC 42010</td>
</tr>
<tr>
<td>Software architecture</td>
<td>Software architecture involves the structure and organization by which modern system components and sub-systems interact to form systems, and the properties of systems that can best be designed and analyzed at the system level.</td>
<td>[14]</td>
</tr>
<tr>
<td>System architecture</td>
<td>The underlying structure of a system, such as a communication network, a neural network, a spacecraft, a computer, major software or an organization.</td>
<td>[31]</td>
</tr>
<tr>
<td>Information systems</td>
<td>Architecture is relative depending on ‘who’ you are (see also figure 1).</td>
<td>[12]</td>
</tr>
</tbody>
</table>

5 Strategic Approaches

In the context of inter-organizational innovation, Andersson, Lindgren and Henfridsson study a process of architectural knowledge development [32]. Architectural knowledge is defined as "knowledge developed and enacted in innovation processes of aligning heterogeneous business and technical elements". This definition draws from n Henderson and Clark’s theory of architectural innovation. According to Henderson and Clark “the essence of architectural innovation is the reconfiguration of an established system to link together existing components in a new way” [33]. Thus, in this view innovation is the result of changes in assembling already existing components that remain the same, while radically improving customer value and satisfaction. It refers to those: “innovations that use
many existing core design concepts in a new architecture and that therefore have a more significant impact on the relationships between components that on the technologies of the components themselves” (idem.). Andersson et al. (2008) define architectural knowledge as a specific type of knowledge concerning how to draw linkages between each of the components. In the following paragraphs we elaborate on three important architectural knowledge concepts, namely: modularity, layering and end-to-end topologies.

Henderson & Clark have identified modularity as a key concept for architectural innovation. This is a concept initially introduced by Simon who identified the property of “near decomposability” of complex systems [34]: “Such systems consist of a hierarchy of components, such that, at any level of the hierarchy, the rates of interaction within components at that level are much higher than the rates of interaction between different components. Systems with this property are called nearly completely decomposable, or more briefly, nearly decomposable (ND). The explanation for the ubiquity of the ND property is that, under the usual conditions of mutation and/or crossover and natural selection, ND systems will increase in fitness, and therefore reproduce, at a much faster rate than systems that do not possess the ND property”. Nearly decomposable systems tend to be better in adapting to their environment than systems that do not exhibit this property. The importance of architectural modularity has been identified repeatedly by design theorists from various fields such as: civil architecture [35, 36], product design [37], software development [38], innovation studies [39], developmental economics [40, 41].

Aiming for architectural modularity is a key strategic direction in the design of robust heterogeneous arrangements that include significant technological components, but this is far from straightforward. The aim for Service Oriented Architectures [42, 43] where the modular structure consists of services is an exemplary case of applying the modularity concept.

Layering is an architectural concept frequently used complementarily to modularity when developing strategies for complex interconnected systems. Layering has been traditionally employed by software engineers that came up with the concept of multi-tier architectures to disentangle the complexity of multiple interconnected components. Layering can also help reconcile different timeframes and lifecycles of various components within the same system. The “shearing layers” idea from traditional architecture conceptualizes buildings as a set of components that evolve in different timescales [44]. Similarly, complex interconnected systems can be viewed as sets of components with qualitatively different rates and scales of change [45, 46] and be constructed in shearing layers, with a clear demarcation between parts that should change at different rates.

Finally, a third concept that contributes to our architectural knowledge is the topological “end-to-end” concept. An “end-to-end” architecture allows control devolution to the periphery: “the ends”. This allows multiple interconnected components to be gradually replaced, expanded or eliminated without threatening the survival of the whole system. The “end-to-end” architecture is widely held to be the key reason for Internet’s flexibility and strong generative capacity [47-49]. What’s more, applying an “end-to-end” architecture means acknowledging that no centralized authority and no well-prepared plan could possibly synthesize all of the knowledge required and anticipate all possible needs.
6 Discussion

In this paper, we have explored the concept of architecture and its use in IS literature. The software architecture literature mainly uses the term to indicate technical objects (components) and their combination. In this view it is possible to predefined relations between components by defining the ‘architecture’ of the system. Encompassing both technical and non-technical components, enterprise architecture literature discusses how to map and structure relations among heterogeneous components. In this approach components are of sociotechnical nature: hardware but also organizational processes including people performing them. The last stream we have described deals with an even higher level of complexity and relates architecture/ing to technical elements, sociotechnical elements and strategic interests such as innovation or generativity. However, moving beyond a mere understanding of the elements characterizing each architectural view, we now trace how different conceptualizations relate to different concerns related to change.

1. **Architecture as a way of determining relations – Design.** Much of the literature on software architecture sees architecture as a prescriptive concept that defines how artifacts should be realized [50]. Gorton sees a software architecture representing a complex design artifact[7]. The term architecture is used to signify a coherent set of principles and rules that guide design. All these principles and rules are about the relationships among components that constitute an identifiable bounded technical system with a certain operational purpose. A requirement for the system itself might be that it will handle turbulences and variation (external change). This is a reactive stance on change, centered on the designed capabilities of the technological object.

2. **Architecture as a way to control evolution – Regulation.** In the enterprise architecture literature ‘the architect’ is responsible for controlling the compliance of novel endeavors to technical standards, business objectives and operational archetypes and architecture has a ‘top-down’ regulatory role. Architectures are exhaustive, fully inclusive blueprints that cover all aspects of purposeful work systems. Even though this “control ideal” has been proved unrealistic in practice for large scale systems with significant social components, it is not abandoned. Recent literature that adopts “ecosystem” views still pursues ways to put in place mechanisms and enabling/constraining structures that can make systems to have desirable behaviors (e.g. be more resilient). These new approaches draw from network theories and biological archetypes in order to pursue new types of control [30, 51].

3. **Architecture as a way of handling complexity – Sensemaking.** In the literature that focuses on the design of multilevel, heterogeneous and large-scale systems (within economy, society, and technology) architectural knowledge is put forward as means for complexity handling. Architectural notions such as modularity, layering and end-to-end topological arrangements have been proposed as ways to conceptualize disentanglement and power devolution for complexity containment. This literature discards the “control ideal” [52, 53] but acknowledges the influence of architectural choices. The emphasis is not on preparing complete maps of components...
and interrelationships but on applying architectural principles and developing an awareness of the choices that are already in place: “An explicit understanding of the underlying architecture is a prerequisite for the design, evolution and maintenance of modern information systems that must complement today’s complex business processes spread across internal divisions and external partners” [2]. Smolander et al. go as far as proposing that multiple dissimilar views of architecture can be maintained simultaneously to accommodate complex relationships and multiple perspectives: “the work by Ciborra (2000) may provide another pointer to deriving architectural specifications that take into account their emergent and improvised nature as opposed to carefully planned common road maps (i.e., maintaining multiple and even conflicting views of architecture simultaneously.” (idem).

7 Conclusion

In conclusion, in this paper we have explored the concept of architecture and its use in technology and organization studies. We have identified three discourses on architectures: one concerned with technical objects, one extended to cover both technical and non-technical components of enterprises, and one developing an explicit strategic interest in architectures. Based on an understanding of architecture as communication tool, we have then examined the different views with a focus on understanding change. In the first view, architectures are used in order to bring into existence something that did not exist previously: prescriptive architectures are used to build new technological artifacts with predefined behavior. In the second view, architectures are related to a regulatory concern. The purpose here is to control changes within complex sociotechnical arrangements (such as enterprises). Finally, in the third view, architectures serve as sensemaking instruments that can support complexity handling. Taken together, the identified range of architecture related conceptualizations can help developing a sharper understanding of a notion that remains ambiguous although extensively used.

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Value Creation in Digital Ecosystem – A Study of Remote Diagnostics

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Abstract. The advancement of digital technologies is driving traditional product oriented businesses to move from selling product to selling solutions. In order to exploit business potentials from technology, it is necessary to understand the technological capacity and how it influences the value creation in the environment where it is deployed. I study remote diagnostics as an example of digital technology within the vehicle industry. I found that this technology provides potential to generate new value. To create this value, traditional product oriented organizations are required to create value in different way than traditional mode of creating value. In this paper, I show that how generative capacity of remote diagnostics technology creates value in digital ecosystem.

Keywords: Value creation, digital innovation, generativity, digital ecosystem, layered modular architecture, remote diagnostics

1 Introduction

With advancement in digital technologies, there are increasing trends in traditional product oriented business to move 'from selling products to selling solution' or 'system selling' ([1][2][3]). Like other manufacturing industries, this phenomenon can be observed within the vehicle industry. Further, there is an increasing interest in finding innovative ways for value creation, especially in digital innovation literature. It has been argued that digital services create new opportunities for value creation and help a company to gain agility [5]. These opportunities suggest that locus of value creation resides within the network rather than within an organization’s boundaries [3], [6]. This requires organizations to develop and maintain multiple parallel business models within a digital ecosystem to increase exploitation from the technology [3], [4]. Further, [7] argue that to create value out of digital technology in digital ecosystem firms should constantly asked which layer to close and which layer to open in layered modular architecture. A layered modular architecture emerges when physical products are embedded with digital capabilities. An example of such architectures in the vehicle industry is when subsystems of a vehicle are becoming digitized and connected through vehicle-based software architectures. A vehicle has
become a computing platform on which other firms outside the vehicle industry can develop and integrate new devices, networks, services, and content [8].

There is research describing the role of information technology (IT), in general, in creating business value and building sustainable competitive advantage [9], [10], [11]. In information systems (IS), researchers have studied remote diagnostics as a value creating technology in manufacturing industry. But the digital technology’s influence on physical products has not been addressed in the IS literature on larger scale [7]. To consider this, researchers (such as [12]) emphasize that IS researchers should be actively involved in studies during the development of technologies rather than after their introduction in the market. Finally, [7] argued that IS scholars should identify new sources of value creation such as generativity. They state that “IS scholars must imagine new digital strategy frameworks that identify new sources of value creation such as generativity, heterogeneity, digital product platforms, and meaning-making capability.” Hence the research question is How does the generative capacity influence value creation in digital ecosystem?

The aim of the paper is to inform managers that build strategy in changing business environment within the vehicle industry. Moreover, the paper will contribute to an understanding of value creation in changing business environment in the vehicle industry.

2 Literature Review

The following sub-sections provide review of the literature on value creation digital innovation in ecosystem and on the concept of generativity.

2.1 Value Creation and Digital Innovation Ecosystem

Digital innovation is defined as “the carrying out of new combinations of digital and physical components to produce novel products” [7]. In their earlier work they showed that digitization (i.e. encoding of analog information into digital information) is an important stimulus of digital innovation. An example of digitalization is embedding digital technology such as remote diagnostics systems in vehicles. Furthermore, the digitalization, in turn, makes physical products programmable, addressable, sensible, communicable, memorable, traceable, and associable [13]. The focus of such innovation is based on product innovation and is different from existing IT innovation which is mostly concerned with process innovation [14]. The services enabled by digitalization are called digital services [7], [13] and innovation in services is called digital service innovation. Driven by advanced development of digital technology digital services differ from conventional services and inherit properties from digitalized products as well as from services, hence possessing the hybrid nature [7].

The embedded digital technology have three key features that differentiate this new technology from earlier ones are (i) re-programmability that relates to the ability of devices to be re-programmable enable separation of semiotic functional logic of device from physical embodiment; (ii) the homogenization of data which refers to the
binary representation of data and together with emergence of new media separate the content from medium; and (iii) the self-reliance nature of digital technology means it requires the use of digital technology [7]. The advantage of using digitalized artifacts include new dimensions to service relationship as embedded sensors can become eye and ear of remote service provider [13] who can access real-time data and in turn can provide seamless services to customers.

Value creation in digital ecosystem where innovation is at the core has been discussed in extant literature. The use of new technology can create value for firms when they develop innovative ways of doing things [15]. If innovation of products and services increases customers’ satisfaction during its use, new value is created [16], [17]. It also relies on a firm’s ability to innovate [18]. Value creation through digital innovation is facilitated by the protection of property rights, use of dominant design and complementary assets [19]. It has also been observed in the past that innovative information technology helped firms in transforming their business and changing customer relationships [20]. Moreover, over the past few decades, digital innovations depict positive impact in various business sectors such as banking sector, chemical industry, tourism, insurance industry [21] and aircraft maintenance [22].

Although the previous studies shows that digital innovation enables new business opportunities [23], there is need for more research on influence of digital technology on value creation and customer relationship [21].

2.2 Generativity

Generativity or generative capacity refers to the ability or power to generate of produce something. It has been defined as “a system's capacity to produce unanticipated change through unfiltered contributions from broad and varied audiences” [24]. The concept of generativity has multiple meanings in various disciplines such as psychology, linguistics, organization science, social psychology, architecture, computer science and social studies. Although the term has been around since 1950 but in terms of technology and products it was used by Zittrain. In terms of digital innovation, generativity is defined as “a technology’s overall capacity to produce unprompted change driven by large, varied, and uncoordinated audiences” [25]. According to [25] generativity is a function of a technology’s capacity for leverage across a range of tasks, adaptability to a range of different tasks, ease of mastery, and accessibility.

Since the introduction of the term with respect to digital technology, there have been studies that try to explain it as concept in different contexts. For example, one of the themes related to digital technologies argue for kind of architecture for digital products. This new architecture consists of a continuum having modular architecture at one end and layered modular architecture on the other end [8]. Generativity in a layered modular architecture is accomplished through loose coupling across layers whereby innovations can spring up independently at any layer leading to cascading effects on other layers [26], [27]. It further inherits multiple design hierarchies,
produces differences in kind rather than differences of degrees, and is constrained by characteristics of physical components of products.

Table 1. Generativity in Modular and Layered Modular Architecture [8]

<table>
<thead>
<tr>
<th>Generativity in Modular Architecture</th>
<th>Generativity in Layered-Modular Architecture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single design hierarchy</td>
<td>Accomplished through loose coupling</td>
</tr>
<tr>
<td>Flexibility of the architecture produces differences in degree</td>
<td>Generativity of a layered modular architecture produces differences in kind.</td>
</tr>
<tr>
<td>Generativity is not constrained by characteristics of physical components of the product</td>
<td>Unlike layered architecture, the generativity of layered modular architecture is constrained by characteristics of physical components of the product (e.g. forms factors and availability of certain physical components)</td>
</tr>
</tbody>
</table>

The generativity of layered modular architecture comes from a firm’s ability to design a product platform that can attract a large number of heterogeneous and unexpected components that belong to different design hierarchies [8].

3 Research Approach and Method

This paper reports on three years research study at GlobalAlpha (pseudo name of organization), a manufacturer of vehicles (buses). The research project is carried out in collaboration among our research group and number of organizations that share common interest in remote diagnostics technology. From a research perspective, I are interested in studying the system in practical setting, while the organizations are interested in looking to deploy it in their business setting. The project was aimed to explore and design the services or solutions based on remote monitoring and predictive diagnostics. Different stakeholders from the industry such as vehicle manufacturers, customers, users, and public transport companies were involved in during the research activities. The project was organized in such a collaborative way that it can be termed as action research [28], [29].

With the development of remote diagnostics technology, GlobalAlpha is expecting to expand its business by providing innovative services to its customers. At present, the major business of the organization is based on selling vehicles. Although some of the maintenance services are provided to the customers with the help of signed contracts. These contracts require maintenance services according to fixed schedule of time. Despite these regular and fixed maintenance services, the customers (bus operating companies) are still experiencing unexpected breakdowns. Hence, GlobalAlpha decided to introduce the technology in order to minimize unexpected stoppages because of these breakdowns. The company also see a business opportunity out of the
remote diagnostics technology. The aims with the technology are not only to implement technology that enables remote monitoring and diagnostics of the vehicles but also to predict the faults in advance. The remaining aim with the technology is to explore and develop services out of this new technology.

Since the remote diagnostics technology provides potential business by addressing customers’ problems, hence it is important to identify and develop the services based on the customer needs. Neither of the members from GlobalAlpha can identify all the customer needs. So, I find it necessary to talk not only with the people from the company (GlobalAlpha), but also with the potential customers as well as other stakeholders. The purpose was to gain a deep understanding so that maximum possible services can be developed with the help of the technology.

Participants of this project include three informatics researcher, three technical researchers, two service developers, three technology developers, and a project manager from GlobalAlpha. While other participants include service technicians, business manager, bus drivers from customers’ side. The authors of this paper are among the informatics researchers who actively take part in different activities. I conducted number of various activities in order to collect data together with different participants from the vehicle industry. These activities include meetings, workshops, interviews, observations, and e-mail correspondences. Public transport operating companies are among the customers of GlobalAlpha. To gain customer perspectives, I conducted workshop, interviews with the traffic managers, service technicians and the drivers of these companies. The following table shows the activities and participants:

Table 2: List of activities

<table>
<thead>
<tr>
<th>Activities</th>
<th>Participants (Numbers)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service development meetings</td>
<td>• Service Developers (2)</td>
</tr>
<tr>
<td>(Biweekly and on-demand)</td>
<td>• Project Manager (1)</td>
</tr>
<tr>
<td></td>
<td>• Technical Researcher (1)</td>
</tr>
<tr>
<td></td>
<td>• Informatics Researchers (3)</td>
</tr>
<tr>
<td>Workshops</td>
<td>• Business Area Representative (3)</td>
</tr>
<tr>
<td></td>
<td>• Informatics Researchers (3)</td>
</tr>
<tr>
<td></td>
<td>• Traffic manager (1)</td>
</tr>
<tr>
<td></td>
<td>• Drivers (2)</td>
</tr>
<tr>
<td></td>
<td>• Service technician (1)</td>
</tr>
<tr>
<td>Monthly Project Meetings</td>
<td>• Service Developers (2)</td>
</tr>
<tr>
<td></td>
<td>• Project Manager (1)</td>
</tr>
<tr>
<td></td>
<td>• Informatics Researchers (3)</td>
</tr>
<tr>
<td></td>
<td>• Technical Developers (2)</td>
</tr>
<tr>
<td></td>
<td>• Technical Researchers (3)</td>
</tr>
<tr>
<td>Interviews</td>
<td>• Business Area Representatives (3)</td>
</tr>
<tr>
<td></td>
<td>• Maintenance Manager (1)</td>
</tr>
<tr>
<td></td>
<td>• Service Developers (2)</td>
</tr>
</tbody>
</table>
In the data analysis process, as data analysis materials, meeting notes from service development meetings and monthly project meetings, the transcription of interviews and workshops and the documents are used. This process consists of two stages: first stage consists of coding, and, second stage consists of looking at material from generativity concept. The materials are coded using the qualitative coding types described by [30]. I used three types of coding: descriptive coding, topic coding and analytical. Descriptive coding allowed me to store the information about the interviewee (for example, a traffic manager in a public transport operating company). Topic coding allowed me to code the topic that is being discussed in the text. The examples of such topics include repair, cost, time, and maintenance when the texts are coded. Finally, analytic coding helped to identify what’s going on in a passage of text, i.e. identifying several themes that are worth noting and not known before. Then I proceed with next stage of analysis by using the concept of generativity related to remote diagnostics technology. This part provides the two value systems that can be enabled by the technology. Although examples are provided with the specific quotations from the interviews, the material also presents the findings from the overall findings from the empirical base.

5 Research Findings

GlobalAlpha is a manufacturer of different types of vehicles used mainly in transport industry. The company is a part of larger manufacturers of buses, trucks, cranes etc. Maintenance and other vehicle related services are among the biggest business in after-sale sector of the company. It provides the services to customers in such a way that they can concentrate on their core operations, knowing that their fleets are receiving attentions from the specialists. By adding remote diagnostics technology, GlobalAlpha envisions to provide efficient and effective service with improved quality and uptime.

During the project, a number of problems related to after-sales business were identified.

5.1 Problems Identified

The service business is done by selling spare parts and upgrades, as well as providing maintenance and other services. The main goal of the service department is to reduce the number of break downs of vehicles so that operations of the public transport company are not put on holds. By minimizing upholds and keeping uptime high, value can be created for customers (Armistead and Clark, 1991). On the basis of material collected during different activities, a number of problems are identified.
These problems can inform about how remote diagnostics technology can influence service provisions. The problems are as follows:

**A poor way to communicate information.** The information about bus problems is often reported through bus driver to the manager at bus operating company. Moreover, the drivers have to write information manually in a form which is then transferred to the system. The manager then decides to report the problem or to skip it. This results in heavy communication without precise knowledge about the fault or problem. Further, the driver does not understand the error codes.

**Errors go undetected and/or unreported.** The driver driving the bus does not have any responsibility over the functionality of the bus. Since the driver does not understand the error codes, he just skips it and does not report.

**Time wastage.** Most of the time at service workshop is wasted to detect or find accurate reason for problem, waiting for ordered parts (in case of unexpected breakdown). It is also evident that the technicians have direct connections with customers. So the customers call them directly over phone. This kind of relationship does not produce direct income but contribute to the goodwill of the company.

**Lack of skilled workers.** Service departments at different places also realized that it is very difficult to find workers with the right skills. It takes at least couple of years to learn the basics and even more to master it.

**Information about usage.** Today, it is difficult for GlobalAlpha to get feedback from the field about the current status of buses and how they are used over time. The information is not only useful in better diagnostics of problems but also is valuable for product development over the long time of period.

**Problems with existing knowledge.** The existing database is not used in its full potentials since there is no way to extract information and couple it with the information from the field.

**Ease of use.** Due to highly technical and poor communication of information, it is difficult for the users to use the system properly and efficiently.

### 5.2 Value creation

The basic architecture in this technological solution is remote diagnostics system where bus is embedded with sensors that register data about the crane and then transfer it to the control system. The control system then transfers data to analytical and processing unit where it is analyzed to find about the current status. Critical problems or otherwise are diagnosed in this way and two value systems are identified: (i) one with users as passive receivers of the services – the customers in this case have signed contracts with GlobalAlpha and rely on the company to diagnose and repair the faults. In this scenario, the technology can provide value to service departments in terms of providing accurate and precise information to the service technicians. It will also save time, address skilled workers’ shortage, record previously unreported errors, and provide information about usage for GlobalAlpha service department; and (ii) customers in this case own service workshops, so they are not passive receive of services i.e. they are not dependent on GlobalAlpha for repair services. But they still have the problems of unexpected errors, skilled workers’ shortage, poor knowledge about their vehicle usage and so on. Hence, diagnosing the problem and reporting it to the bus operating company is a potential business for GlobalAlpha. The differentiation of this setting is from previous one is that control unit is placed at
customers’ place where technicians can use it to detect faults. Hence, in this case the
customers are partially dependent on solution providing company i.e. for diagnostics
only.

6 Discussion and Concluding Remarks

In order to answer how generative capacity influence value creation in digital
ecosystems or networks, I illustrate value creation in these types of situations. It has
number of characteristics on which it depends upon.
Since it is generative capacity and multilayered, and it is on the service side and not
the other side, I need to cope with both structures in these networks i.e. to cope with
the whole span of continuum. Because some structures are on the modular side and
some are on the layered modular side. So if the question is how it influences the value
creation? Then the answer is that implications suggest that I need to cope with the
whole structure for such value creation situations. Findings also show that two types
of or multiple value systems exist because of generative capacity. Further, passive
customer’s value system need to expand with active customers’ value system.

I conquer with [7] that the primary source of value creation is the generativity and it is
emerged when heterogeneous resources mix-and-match their capabilities in an
unbounded manner. Finally, in such digital ecosystems, to maximize generative
potential of technological architecture, it is essential for an organization to design
digital product platform that can inspire and mobilize others. Finally, in managing
such a network, a firm needs to develop the capability to create new meanings of its
products and services [31]. This should be done by constantly redefining the product
boundaries through active reshaping of the digital products in the ecosystem [32].
The sector (i.e. Vehicle Industry – the context of research) provides the limitations to
the study. Moreover, the study is conducted in one of the Nordic countries, hence the
cultural aspects about innovation also provides additional limitation when it comes to
generalize the results/theoretical contribution in other geographical regions. However,
the study provides useful insights on how digital technology provides generative
capacity in product oriented business. A similar study can be conducted in other
industry and a comparative analysis can help to generalize the results.

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Design Principles for a Quality Assessment Artifact Supporting the Selection of a Cloud-based Preservation Solution

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Abstract. Commercial organizations must retain increasing amounts of data in a long-term perspective. ENSURE is a project aiming to exploit the emerging ICT by evaluating the costs, risks and benefits, demonstrate how to use new information technology (cloud computing) to enable scalable solutions for digital preservation. Commercial organizations will be faced with the choice and configuration of cloud-based preservation solutions, based on cost and quality. This paper is part of the ongoing work of developing a decision support artifact based on Quality of Service. We present the basis for the identification of three Meta Design Principles to use as the basis for the subsequent phases of design and implementation of the decision support artifact; they will also be useful for others to develop artifacts for Quality of Service evaluation.

Keywords: digital preservation, cloud computing, decision making, quality of service, trusted digital repository

1 Introduction

Ensuring access to digital objects for a long period of time is a challenge in the digital library community [1], [2], [3], [4], [5]. With the increasing volume and need to save data in a long term perspective, issues of digital preservation have made its entrance in the commercial sector as well. The interest for digital preservation relates not only to the preservation of our historical description for future researchers, for the commercial sector it’s also interesting for fraud protection and legal requirements for traceability. Examples of commercial sectors where the preservation of digital records is of special interest are finance and medical healthcare where proof of the information they rely on is valid, providing digital content for the next decades have become part of their business model.

Preservation of digital material for a long period of time is a highly complex and diverse matter because of the rapid change of formats, and fast technical advances of software and hardware infrastructure. Digital assets that has to be preserved for future use consists of a large variety of materials with a wide variety of requirements not
only regarding format and technical infrastructure requirements, but also the monitoring of its environment in order to ensure usability over time [6].

A critical problem in developing preservation systems is the process of validating whether the delivered solution effectively reflects the validated requirements [7]. With the advent of preservation issues into the commercial sector, which usually is not in possession of preservation nor cloud computing expertise, the importance of support for decisions on these issues has increased [8].

Due to the rapid expansion of the Internet software-as-a-service (SaaS) has matured from an over-hyped software model to a realistic option for on-demand computing and a transition of the software industry to a new service model is an inevitable fact [9]. This service model will also be a realistic option for long-term digital preservation needs. Disadvantages often highlighted in the cloud computing model as latency and availability problems to primary data may be of less importance for preserved data and cloud computing service models could be suitable for long-term digital preservation.

A scenario could be where a cloud provider offers a secure service while another may not, and if the latter charges half the price, the majority is going to select the "lowest price" service if there is no way to pronounce the difference [10]. There is a need for decision support that exposes both cost and risk factors.

This work is part of the ENSURE (Enabling kNowledge Sustainability Usability and Recovery for Economic value) fp-7 project [11]. Based on use cases in healthcare, financial and clinical trials ENSURE expanding state-of-the-art in digital preservation developing a solution that attempt to assess the costs and benefits in relation to quality that enables a company to choose the most cost effective cloud-based preservation solution that cope with their purpose of use.

To our knowledge, no one has developed an artifact that makes it possible to measure the Quality of Service (QoS) that combine metrics from cloud computing and trustworthiness frameworks adapted for digital preservation and parameters related to the preservation process as the basis for the selection and configuration of a cloud-based preservation solution that cope with needs in the commercial sector. The work as whole regarding QoS includes development of an algorithm able to produce a quality score for comparison and a way to express quality as decision support. The outcome of the artifact will also be part of the design of a preservation workflow. No one has to our knowledge investigated how these theories, frameworks and strategy could be applied for the selection and configuration of a cloud-based preservation service adapted to the commercial sector.

The contribution of this paper is to identify the first Meta Design Principles that meet demands from user requirements and use cases, and complies with theories and frameworks intended to be used for measuring the Quality of Service. As basis for the conceptual background we have studied existing frameworks and approaches in digital preservation and cloud computing related to quality aspects.

In order to identify requirements from users and uses case scenarios we have used outcomes from workshops and interviews with potential users. The use cases and users are from participating commercial organizations from health-care, financial and clinical trial sector.
The rest of the paper is structured as follows: section 2 Research Approach, 3 Conceptual background, 4 the ENSURE Architecture, 5 Usage Context and Requirements, 6 Design Principles, and 7 Conclusion.

2 Research Approach

The purpose and scope of this work is to establish general design principles to support the development of artifacts that support users in commercial organizations in the selection of cloud-based conservation system based on Quality of Services (QoS) and principles for how QoS can be performed in this context. This work will also contribute to the development of cloud-based preservation solutions composed of assembled micro-services. The work is to be implemented and validated in a preservation planning artifact based on an estimation of costs, economic performance and quality. The goal of this paper is to identify the first Meta design principles of an artifact to predict QoS. The approach of this paper follows the section "Identifying design principles" (figure 1). As a basis for this work, we studied the literature related to the topics digital preservation and cloud computing, and applied approaches within those who are dealing with the validation of solutions and services. As a basis for identifying requirements related to the use case scenarios and users that will affect the design of our solution, we used the results from workshops and conducted semi-structured interviews with users within the organizations involved. Participating organizations are from the commercial sector and representing health care, financial and medical trials. We intend to use a Design Science Research approach [12] following the process illustrated in figure 1. This paper covers the first part that results in Meta Design Principles as input to the next phase where the artifact is implemented and tested. The test to be applied is according to Hevner et al. [12] is experimental, where we intend to study the artifact in a controlled environment for usability. Since design science is an iterative and incremental process, the evaluation phase will contribute with the necessary feedback to the design phase in development of the artifact.
3 Conceptual background

This section describes the theoretical backgrounds and motivation for the research and development approach.

3.1 Digital Preservation and Cloud Computing

Previous research in the field of long-term digital preservation has mainly focused on the preservation of our digital heritage [1], [2], [3], [4], [5]. With its entrance into the commercial sector, new objectives have been identified as fraud protection and legal requirements for traceability in sectors such as finance and health care. We also see the introduction of new types of preservation solutions based on new technology platforms as cloud computing services [13], [14]. Long-term digital preservation could briefly be summarized as the ability to ensure access and understanding of digital information over time. The complexity is to preserve an inscription of characters on a physical medium, the logical object is identified and processed by software, and that the conceptual object can be interpreted and understood by a designated community. To ensure the continued interpretation there are two major strategies; migration or emulation [15]. In long-term digital preservation, a framework of significant importance is the Open Archival Information System (OAIS) framework [6]. OAIS is used as a fundamental ontology for preservation systems defining functional units, content and structure of information packages to be preserved. The framework has also become the standard for the nomenclature used in the field of digital preservation. Functional entities described at an abstract level in OAIS (figure 2) are Ingest; responsible for receiving content and to create a preservation package, Data management, Preservation planning, Storage, and Access. One important aspect is that it is an abstract framework and must be translated into
specific implementations which allow for interpretation and thus a variety of specific implementations in various preservation systems [16], [17], [18]. Because OAIS is abstract and there are variations in the implementation of each preservation solution, there is a need to ensure that a solution is OAIS compliant, meets the functional and non-functional requirements.

Trust has become an established concept that pervades the audit assessment of a preservation solution. It's not enough to say that a solution is OAIS-compliant, there must be an independent basis for carrying out the assessment of the fulfillment of trustworthiness [19]. To support a review of whether a preservation solution meets the requirements specified in the OAIS, and also in possess of an organization of procedures to ensure the safe management of content, audit frameworks has been developed as an Audit Checklist for Certification of Trusted Digital Repository and DRAMBORA [20], [21].

These frameworks articulates the attributes and responsibilities on the expectations of a trusted digital repository divided into different sections as organizational infrastructure and administrative responsibilities including financial viability, staffing, skills, procedural accountability, procedures for handling digital objects, content creation and access procedures, support for preservation planning and technical infrastructure and security risk management mechanisms.

Cloud Computing refers to both the applications delivered as services over the Internet and the hardware and software in the central servers that provide these services. Due to the increased power and infrastructure development, the software engineering and cloud computing bandwidth capacity to support new levels of service and has become attractive for new areas of computing. Cloud computing is a significant trend with the potential to increase flexibility and reduce costs, but this is associated with security risks, lack of developed technologies and standards, which means that many organizations are reluctant to cloud solutions [22]. Applications suitable for hosting the external cloud are software that has low security exposure and is not critical. In the near future is expected to cloud services become more mature and a large part of the organizations applications and data will be placed in the cloud.
Cloud computing is a computing paradigm where data services and data residing in the shared resources of the scalable data centers, and these services and data are accessible via the Internet. Cloud computing is usually divided into three basic categories of services: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS): Software deployed as a hosted service and accessed over the Internet. Cloud services are also defined as if it is available via the public Internet called a public cloud service. It is also possible to build an internal IT environment with cloud computing characteristics, called an internal or private cloud [22]. Among the properties considered emphasize the benefits of cloud solutions is that they are based on scalable infrastructure, offering flexible configurable resources, short installation time, only the actual consumption of resources billed, the infrastructure shared by several tenants, available over the internet from any device. Cost savings with low initial cost is attractive for many small and medium sized organizations and lower operating costs because organizations no longer need to purchase a huge infrastructure (server) park to handle peak loads [23].

There are also risks in moving data and applications to external clouds. Risks related to the data stored and delivered via the Internet. Sharing resources with other tenants also means that the organization's data can be placed on the same resource that competitor when it is very difficult to ensure the isolation of data. The precarious situation of data can also pose a risk of breaking laws governing geographic location of data. No standards exist for managing service level agreements (SLA) that can be used to help ensure compliance with regulations. Security is an important aspect when it comes to the location of applications and data to external cloud where a service in many cases consists of several sub-providers. There may be safety rules which require that all data in transit and at rest is encrypted. When data is moved outside the organization, it also means that it becomes more difficult to monitor if critical security updates are up to date or if resources are subject to unauthorized access attempts. Another risk is vendor dependent and is locked to a specific cloud service that has its own application programming interfaces [22], [23].

The report on digital preservation and cloud services [24] identified a number of desirable features and issues useful when choosing a cloud service for digital preservation. The report includes functional features like support for maintaining data integrity checksum generation when ingesting digital objects, support for periodic validation of checksums, and support for calculating checksums on network traffic to detect data corruption. Not maintaining integrity and availability of data in a collection may have significant legal consequences if there are contractual obligations. The report identifies the need of reliable storage where support for redundant storage in multiple locations may be desirable. Type of storage media can also be important where you should access to metrics that declares how many bits of data that can be read before failure and the mechanisms for data recovery should be available. One feature considered important according to Green Toussaint & Rounds [24] is portability: there are examples of cloud providers that make it difficult and expensive to move data from their cloud service to another provider.

Assessing cloud services require a set of metrics selected. There is no systematic discussion of what metrics should be to evaluate cloud services. However, there are
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initiatives such as Cloud Services Measurement Initiative Consortium (CSMIC) formed to address the need for industry-wide, globally accepted measures for calculating the costs and risks of cloud services [25]. Evaluation of performance and economics have learned from evaluations of traditional computing systems and by understanding their catalogue of metrics, more sophisticated metrics in different domains can be developed for better evaluation of Cloud services and there is a need for a continually enrichment of new evaluation metrics [26].

In this section we presented the conceptual background and motivation for the assessment of Quality of Service for cloud-based preservation solutions. We argue that our work should build upon concepts in digital preservation for the assessment of trustworthiness combined with metrics from cloud computing identified as appropriate in this context. The artifact will be part of a decision-making artifact supporting the selection of solution components and configuration of a preservation process in a cloud-based multi sub-provider federated solution.

4 The ENSURE Architecture

This section describes the ENSURE Preservation Engine component architecture and type of data to be handled in the use case scenarios.

4.1 ENSURE – Runtime Environment

The ENSURE (Enabling kNowledge Sustainability Usability and Recovery for Economic value) [11] is a project part of the 7th Framework Programme. Guided by real world use cases in health care, finance and clinical trials ENSURE extends the state of the art in digital preservation, which to-date has primarily focused on relatively homogeneous cultural heritage data. One objective in this project is to evaluate the cost and quality of different solutions enabling a business to choose the most cost-effective preservation solution with a quality equivalent to the purpose of use supported by the preservation plan configurator described in more detail in this section. Another objective of the project is to utilize emerging ICT supporting the evaluation of costs, risks and benefits of using scalable solutions for digital preservation, particularly in view of Cloud Storage and virtualization technologies.

Besides the preservation configurator ENSURE runtime engine (figure 3) consists of components Preservation Digital Asset Lifecycle Management (PDALM) based on industry standard lifecycle management methods to manage the preservation lifecycle, meet regulatory compliance, authorize changes in the preservation strategy to reflect changes in the environment, address evolution ontologies and manage the quality of digital objects over time. Content-aware Long Term Data Protection: Provide data protection over long periods of time, manage change personally identifiable information, new and changing regulation and manage user identities for decades.
Heart of the preservation runtime engine system is the Preservation Data Stores in the Cloud (PDS Cloud) component (figure 3) which is a preservation aware-storage service infrastructure component employing multiple heterogeneous cloud providers providing functionalities as data management and storage. The ability to easily switch between different cloud service sub providers is a key factor ensuring economic viability of a preservation solution. PDS Cloud [27] supports the concept of logical preservation information object storage using a brokering component between entities in the preservation runtime system and physical storage and compute cloud providers. PDALM is running the preservation workflow (invoking needed components) from the "hand over" and information preparation, through addressing consequences of media obsolescence and access requests, to deletion of the object if not longer regarded as needed. Rules for managing PDALM is provided by the preservation plan configurator. The preservation plan configurator is responsible for the specification of components to be in use in the preservation runtime engine that matches the organization's preservation needs based on cost, economic performance and estimated quality for purpose of use. The preservation plan optimizer communicates with the components of cost (COE), quality (QOE) and economic performance (EPAE) through a web service interface. The idea is that the output from the components to be sent back to the configurator as a basis for decision-making supporting the selection of a preferred preservation plan. The preservation plan is then used as specification of components and configuration of these components to be executed by the preservation engine PDALM.

The digital objects that are subject to preservation in the use cases consists of patient medical data limited to medical DICOM images, medical encounters XML files which represent the doctor's summary report, and PDF files which represent general informational files ("information pages") that need to be stored in the system but are not directly related to any particular patient. Financial services data will be limited to client data in PDF file format and market data in CSV (comma separated values) format. The medical encounter reports need to be stored for seventy years, the medical images need to be retained for a minimum of forty years, and may be transformed to containers only the region of interest after twenty-five years, information pages need to be retained for only ten years. Financial services client data will be stored for 15 years and the market data need to be retained for 40 years. Scenarios defined in the ENSURE project and the Quality Optimization Engine (QoE) responsibilities covers aspects of quality for both data and quality of service. This paper covers the identification of the first Meta Design Principles for the QOE approach of assessing the Quality of Service.
5 Usage Context and Requirements

The basis for the compilation of use case scenarios and requirements has been collected from workshops and interviews of users in the project.

5.1 Use Case Scenarios

Three different organizations from the commercial sector are participating in this study:

A health-care organization responsible for keeping medical records for a long period in time, a decade due to regulatory compliance or for ever for ease claims purposes and research. The organization are in possess of a large amount of data in a range of formats, many non-standard and proprietary, representing textual data, images, lab tests, etc. Part of the medical records need to be stored for seventy years, and medical images need to be retained for a minimum of forty years.

A capital management company that use high-volumes of data for predictive decision making models for the financial sector. There are no regulations according to preservation of this data but the data does bring business value to these organizations due to a verification process of the predictive models in use against historical data. Preserving these data in a safe and affordable way is an important business issue.

A company responsible for clinical trial data on new medicine. Every clinical trial collects a vast amount of personal data on each participant. Data that has to be handled in such way that it will not be at risk to be compromised, manipulated or
mixed up and where good search ability and access is guaranteed. These data are important for future research and studies and traceability in case of litigation and has to be stored for fifty years enabling secure sharing over time which also protects privacy rights.

Images are a significant part of medical records that represent a very large portion of medical data (in bytes) and due to the richness of their formats. Keeping it in its original format means high costs and health-care organizations have to consider different techniques for keeping with regards to purpose of use e.g., using data encoding method that compresses data by discarding (losing) some part of the information in the images, deciding which portions of an image need to be kept, or running a greater risk of data loss, after the regulatory requirement has expired. Medical records due to the nature of its data also have to address concerns of long-term protection of personal information and compliance with privacy regulations.

In the financial sector the use of high-volume data for predictive models in the decision making process. The data can contain hundreds of ticks per second. There are no regulations according to preservation of this data but the data does bring business value to these organizations due to a verification process of the predictive models in use against historical data. Many financial organizations make heavy use of predictive models. These models are data driven; for high frequency markets, the data can contain hundreds of ticks per second. While the models are applied to today’s data, they are verified and constructed based upon historical data. In this context there are no regulations that require preserving the data, but the data does bring business value. Often the data used by financial organizations comes from multiple sources, may be copyrighted, and is typically in proprietary formats which come with associated software supporting visualisation and analysis. We are beginning to see a trend in which each financial company doing research (e.g., banks, fund managers, etc.) are building their own databases based upon purchased data. Preserving these databases in a way that is affordable is an important business issue.

A major aspect of bringing a new medicine to market is clinical trials. Today these trials are conducted in hospitals and healthcare organizations throughout Europe. Data from medical records may serve as the basis for clinical trials and can be used for outcomes studies and research at the population level. During a trial, a vast amount of personal data is collected on each participant. This data must be stored for fifty years in a way that is usable and secure. We need to guarantee that we can ensure the usability of the information in digital form over the required time in a secure and cost efficient manner, enabling secure sharing over time which also protects privacy rights. We also need to take advantage of the changes in requirements over the information’s lifecycle to reduce cost. We also need to ensure we can find the digital information, in particular as the means of categorizing and classifying the information change and evolve over time.

To make use of the latest ICT advances with cloud-based scalable system for preserving digital content, it is important that it should be able to understand the cost, value and quality of the solution. To date there has been only limited work on evaluating these aspects of digital preservation and most of this work has focused on
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the cultural heritage context. We will go beyond evaluating the cost and economic performance of a deployed solution and will look at modelling the expected quality of different solutions for preserving a set of objects. Example: consider a service provider in the health care domain who needs to keep a set of digital images; to ensure that the right solution is selected and deployed; the provider needs the ability to quantify the costs, benefits and quality aspects of different approaches. Common for these organizations is that the value of their data holdings and use of it as information will change over time but there is always a need to be able to ensure that these digital objects is correctly managed at each point in time.

Compilation of requirements:

- Need for long-term commitment to the preservation of data but different type of data needs to be managed for different lengths of time.
- Data are in different formats and needs to be handled in different ways due to different requirements depending on regulatory compliance.
- There is data which is considered to provide significant business benefits in a long-term perspective.
- Some type of data may not be at risk of being lost, tampered with, or mixed up, and where accessibility must be guaranteed.
- There is data considered important for future research and study and traceability in the event of litigation.
- For some data protection of personal information and compliance with privacy regulations is very important.
- Some data could be exposed for a greater risk of data loss, after the regulatory requirement has expired.
- There are organizations that need to manage and execute large volumes of data in a cost effective manner in which storage capacity and computing power are important.
- There is a need to be able to take advantage of changes in the requirements of information lifecycle to reduce costs.

5.2 User Interviews

The basis for identification of user requirements consists of interviews with three persons (informants) at management level. Persons considered being a type of future users of the system. The interviews were conducted at six occasions; two for each informant. The interviews were semi-structured, following an interview guide that was sent to the informants in advance. By semi-structured is meant that the informants were given opportunity to speak freely, and the interviewer could ask follow up questions to clarify what was said. One of the informants answered the questions in writing, before the actual interview (conducted in two steps) where further elaboration on the answers was provided. All interviews were carried out via telephone, and they were recorded.
The organizations will be named as FO (the financial organization), HCO (the health care organization) and CTO (the clinical trial organization). In the three organizations the data is used for analyses, decision support, recommendations, and restrictions and for two of them also for research. The informants differentiated between information into four categories; purpose, goal, requirement, and type. By this is meant that what the information conveys and contains differs depending upon what it is intended for. One of the organizations, the CTO, was fully computerized, while the other two show storage of data on many kinds of media, from paper, CD-ROMs, hard discs, servers, databases, to floppy discs.

When asked for what reason/s their organization store information, the informants ranked legal reasons as most important, followed by financial, historical/memory and for research purposes. The second, for memory reasons, was motivated by the informant from the CTO “Cause maybe something can happen with a drug in a study, so maybe we need to be able to contacts the patients that were recruited for the clinical trial, so we need the info of what people were involved in the clinical trial.” However, besides the daily use of information, it was only the FO that explicitly needed the stored information on a more regular basis and specifically once a year for audits. For the others goes that data in use (which they hold themselves) is needed immediately and when finally preserved, the need for the information would only happen occasionally. The informants had difficulties to imagine any alternative use of their data. For the FO it was out of question, due to privacy for their clients. The HCO suggested research as an alternative use, and the CTO mentioned for safety reasons, i.e. surveillance of a drug. However, the informants could not imagine that the purpose of why information is used changed over time.

Moving on to quality issues for preserved material, it was obvious that the informants took it for granted what should characterize the service provider. They referred to availability, reliability, integrity, maintainability, confidentiality, performance, and security as important, without ranking them. When asked what would make them trust the service provider, the informants mentioned reputation, financial status/stability, and experience, staff turnover and knowledge. Regarding digital object management the informants had not reflected much on this. In general they left this matter to the service provider – they had no specific thoughts on this except the FO that stated that security was important: “if we store data with an external service provider we have to be more careful with privacy of data, so there would be higher requirements, than we have ourselves.” The CTO was interested to have their information tagged and indexed, thus they imagined that the service provider could improve their data.

To increase trust in the service provider, recurrent status reports would be a good means, reasoned the informants, and they were also interested in reports on costs, and if something happens or is done with the data. When asking the informants about cloud-based solutions and their thoughts on this, the informants declared that their expertise was not IT, and because of this they were reluctant to rank neither advantages nor risks with cloud-based solutions. Still, the advantages they mentioned were; financial, technological, availability, maintenance, quality, storing, and finally the sharing and accessing of data independent of time and place. Concerning risks, the
informants could identify things such as unexpected changes in the data, security, privacy, confidentiality, and limited availability in case of connectivity problems.

Regarding management of information, the FO especially asked for the possibility to have the functionality of deleting documents in the financial use case. This is a clear difference between the healthcare use cases and the financial one, because, at least for the client documents the FO have clearly regulated retention periods, and after these retention periods have expired they want to delete the documents, and thereby not being responsible for them anymore.

At the FO they saw two advantages with the application of a long term digital preservation system: 1) Automation of the preservation process, which would lead to cost and time reduction, but most importantly to the effect of error reduction through automation (files put to the wrong place, stored in a wrong format, etc.) resulting in increased discoverability and accessibility of stored data, and 2) Improved consistency and completeness of the data, through automated checking and periodic reporting. On the question how they expect to view the information after, say 10 years, the first answer the informants provided was that they would like to see it in its original form. When elaborated, the informants however meant that this does not go for all documents though, it depends on the data. Moreover, the FO has no use for e.g. the client data by the end of the preservation period. Instead, they want to delete the highly confidential client data since it cannot be used by a third part. The only reason for looking at the data after the preservation period that the FO informant could think of, was “for a track record, but this would be a one-time event and not general”. The FO informant could also provide an example of data that could be reduced or compressed, that is market data. For the HCO it was clear that they need to define what changes are acceptable if using a service provider, e.g. what they want in original and what can be reduced. For textual content, after a while plain text will be efficient, for figures and diagrams only original will do. At the CTO original appearance was preferable, and after the regulated 15 years it becomes less important, not least since the chance of having an audit is reduced. After 15 years, “maybe they make it slower and plain text after 15 years, compressing of images… indexing and tagging would be perfect for surveillance or research purposes.”

Compilation of requirements:

- Informants (potential users) can be classified on a level with little understanding of quality of service in the context of cloud computing, and digital preservation. This is natural, given what they face in their daily operations.
- The informants expressed different preservation purpose and use of preserved material and reasons for preservation where legal ranked as most important, followed by economic, historical / memory and for research purposes.
- The informants do not see that a preservation system would be used on a daily basis, but more irregular especially during audits.
- The way to view data could change over time depended on the type of data involved and data could be reduced or compressed when the significance of data decreased.
Key aspects of a preservation solution are reliability, integrity, maintainability, availability, security, and performance.

A service provider’s trustworthiness is based on reputation, financial position / stability and experience, staff turnover and skills.

Regarding digital object management; security is important and periodic progress reports and reports on incidents impacting data.

Difficulties due lack of knowledge to assess the risks, but identified things that unexpected changes in the data, security, privacy, confidentiality and restricted access.

The benefits of the application of a long-term digital preservation system; automation of preservation process, error reduction, improved consistency and completeness.

6 Design Principles

Based on the conceptual background, use case scenarios, and user interviews we have identified the first Meta Design Principles for a quality of service artifact. The design principles will be used as input for continued development of the QOE part of the ENSURE preservation plan configurator (figure 3).

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<th>Design Principle</th>
<th>Motive and related Meta Requirements</th>
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</table>
| Requirements Contextualization    | • Comprises an approach to group requirements with various properties related to the type of object in the collection, regulations and usage purposes. Main reason is that it becomes difficult for the user (preservation planner) to translate requirements into the selection of a variety of metrics, and its weight of importance in this context.  
  • Relates to the Meta Requirements, indicating that users, responsible for preservation planning in commercial organizations is not in possess of skills in digital preservation management, preservation solutions and cloud computing. |
| Weighted Metrics & Impact Prediction | • Defines how to calculate the value of quality and the need to implement an algorithm that reflects the demands on quality of service. An example might be that special security mechanisms must be supported by the type of data associated with the purpose of preservation and use that may be regulated by law or that the business at risk if data is stolen or lost.  
  • Relates to the identified Meta Requirements that point to the need of supporting different purpose of use with differentiated needs. State the requirements for implementation of an algorithm that is weighted towards different metrics corresponding demands on quality of service. An algorithm supporting weighted values can be linked to specific metrics related to specific types of objects |
Design Principles for a Quality Assessment Artifact Supporting the Selection of a Cloud-based Preservation Solution

| **Risk Transparency** | • Summarizes the need to find a way to describe the meaning of the quality assessment for users without expertise in digital preservation and the impact of cloud services on quality of service. We intend to support a way of expressing quality, in addition to scores that facilitate comparison, that express the main risks associated with each solutions in relation to preservation needs based on type of object, the risk of damage to business, and purpose of use.  
• Relates to Meta Requirements that reflect the users' lack of expertise in the field of digital preservation and cloud services and therefore can be considered difficult to interpret if all metrics are exposed to the user. We intend to use metrics based on frameworks in digital preservation and metrics from the field of cloud computing, leading to extensive number of metrics we therefore argue for the need of an approach that expresses the main risks associated with each solution. |

7 Conclusion

With the advent of preservation solutions for the commercial sector with a need to maintain an increasing volume of data over a long period of time, there is a sought-for a cost-effective solution with a Quality of Service (QoS) that meets the purpose of preservation and use. The need for digital preservation refers not only to the preservation of historical descriptions for future scientists, for the commercial sector, it is also interesting for fraud protection and legal requirements for traceability. Preservation of digital material for a long period in time is a very complex and multifaceted issue because of the rapid change of the format, and rapid technological advancement of software and hardware infrastructure in which conventional storage solutions not sufficient. This work is part of a project with the objective to develop innovative cloud computing solutions to ensure long-term benefit of data. A critical problem in developing preservation solutions is the process of validating and configuration of a solution able to meet defined requirements. With the advent of preservation issues in the commercial sector, which usually is not in possess of preservation or cloud computing skills, the importance of decision support increased.

In this paper, we have identified three design principles formulated as Requirements Contextualization; the artifact should provide support for grouping of requirements gathering, with different priorities for each QoS metric reflected by preservation purpose, Weighted Metrics & Impact Prediction; the algorithm for calculating the QoS score should use a weighted key for each metric in relation to its
preservation purpose importance, and Risk Transparency; the artifact should express the QoS result in such a way that the greatest risks are exposed.

A QoS assessment artifact for decision support implemented according to identified design principles, we argue that there is an increased possibility of obtaining a cloud-based preservation solution that is cost-effective and meets the preservation requirements defined by the organization.

There are currently no agreed strategies, models or standardized catalog of metrics regarding the assessment of cloud computing services. Our future work intends to contribute to the identification of QoS metrics and design of an innovative algorithm for calculating QoS scores adapted for cloud-based preservation services. The design principles were defined with the work of the subsequent phases of design and implementation in mind, it will be valuable for others who want to develop QoS assessment artifacts.

The basis for generalizing the result of this work is reduced because the limited number of participating organizations and users. We therefore intend to be vigilant during evaluations and test of the artifact that will continually pursue during the project and used as input for continued development of design principles. This will strengthen the empirical data and contribute to further knowledge about how QoS assessment artifacts for decision support in this context should be designed.

Next we intend to design a model and an algorithm that will form the basis for the calculation and expression of a quality score based on selected QoS metrics in accordance with identified design principles.

Acknowledgements
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References
Design Principles for a Quality Assessment Artifact Supporting the Selection of a Cloud-based Preservation Solution


The End of the Line: Project Management Challenges in Small Software Shops in Pakistan

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Abstract. Most software development companies are very small with only 1-10 employees. In developing countries such companies play an important role both locally and as providers of software and services to customers in other parts of the world. Understanding and improving their project management (PM) practices are, therefore, important not only in the local context, but also in the context of globalized software development. This paper explores actual PM practices in Pakistani Small Software development Shops (SSDS). We find PM challenges in addition to challenges reported by software engineering literature, and we have described the implications of those challenges on quality and productivity of Pakistani SSDSs. We also find that some Pakistani SSDS practices are similar to what is reported from SSDSs in other parts of the world, but other practices are related to the companies' position in the global software development chain.

Keywords: Project management, PM tools, small software shops, freelance portals, PM issues and challenges.

1 Introduction

Small software companies play a significant role in many of the world's economies [2, 1, 10]. In Europe, around 85% of software companies have 1 to 10 employees. [4] These software companies contribute 93% of all IT businesses in Europe and 66% of total employment in the software industry [3, 4]. A survey conducted in Denmark finds that around 89% of IT companies have less than 10 employees. According to a similar survey conducted in the US in 2005, around 80% of companies in the areas of software publishing and customer computer programming services have less than 10 employees [5]. In India; small IT companies represent up to 85% of all software organizations [1]. We have no actual figure from Pakistan, but we assume that similar numbers apply to the Pakistani software sector, since India and Pakistan have similar culture and business styles.

Organizational studies often bundle small and medium sized companies (SMEs) into one category, but the characteristics and limitations of SSDSs differentiate them from medium sized software companies. [1] SSDSs have limited financial and skilled human resources compared to larger software companies. The competition is tough, their software development process is primarily driven by time to market, high
flexibility, high risk orientation, unstructured planning, informal managerial process, and they have limited learning and knowledge absorption capacity [6, 7, 1]. Small companies in developing countries face further challenges i.e. lack of finance, low human resource and technological capabilities, poor project management competences, little access to skilled manpower, deficiencies in marketing strategies, low efforts on R&D and lack of innovative technology [12]. In addition to these challenges; small to medium sized enterprises (SMEs) in developing countries like India and Pakistan face system specific problems i.e. lack of corporate governance structure in the firm, corruption, barriers to trade, and bureaucratic, legal and regulatory obstacles [12]. Small software companies in developing and transitional economies may have limited access to capital due to deficiencies in their banking system or harsh collateral requirements [16].

There is remarkably little research into software engineering (SE) practices in SSDSs in spite of the large number of companies, their economic impact, and their unique characteristics [5, 4, 2, 20, 1]. There are even fewer studies of SSDSs in developing or transitional economies although such companies play an increasingly role in the global software production lifecycle, as software suppliers to companies in other parts of the world.

The purpose of this exploratory study is to study key issues and actual PM practices in SSDSs in developing countries like Pakistan. Therefore we will explore two research questions: what are actual project management practices in SSDSs in Pakistan? And what are the key challenges facing by SSDSs during their project management process? It is part of larger research project that will compare SE practices in developing and established economies.

The paper is structured in six main sections: Related Work, research method results from the interview study, discussion and conclusion.

2 Related Work

There is remarkably little research into the challenges and practices of SSDSs in general and even less about SSDSs in developing countries in particular. This claim has also been supported by many studies i.e. [5, 4, 2, 20, 1]. Research into SE practices in SSDSs includes studies of software process assessment and improvement [4, 20, 8, 19, 18, 10], realization of agile methodology in SSDS [5], configuration management [20], reuse, and knowledge management [8, 1]. Many SPI initiatives in SMEs have been reported i.e. CMM, CMMI, ISO/IEC 15504:2004, SPICE (ISO/IEC 15504:1998), ISO/IEC 12207:2004 and ISO 9001:2000, but the literature particularly discussing SE methods in SSDSs is almost nonexistent [1, 27]. SE literature reports that CMM, ISO 15504, and IDEAL are the most frequently used software process improvement (SPI) frameworks in medium size companies but not a single publication has reported if these three models have been adopted by SSDSs [3, 8, 2]. The perception among SSDSs, however is that these SPI standards and models are very difficult to implement, time consuming, and expensive to apply [22, 25].

An efficient management process is very important for the success of SE projects. [13] The management community in general and project management (PM)
community in particular have, however, proposed little guidance for SMEs to manage their projects and PM Institute has specified that further research is required to streamline PM Body of Knowledge (PMBoK) for SMEs [14].

To our best knowledge, only a couple of publications from Pakistan concern SPI in SMEs but there is not even a single explorative study published from Pakistani SMEs or SSDSs. SSDSs in developing countries do, however, play an important role both locally and as providers of software and services to customers (other software companies or the actual buyer of the product or service) in other parts of the world. [16] Understanding and improving their practices and challenges is, therefore, important not only in the local context, but also in the context of globalized software development. This study, therefore, familiar with actual PM practice in SSDSs, my attention has been caught to focus on exploring the key issues and actual PM practices in SSDSs in developing countries like Pakistan.

3 Research Design

This study comprises of SSDSs whose primary business is software development and they are working as independent software companies have 1-10 employees. We collected data from one of the developing countries i.e. Pakistan. We selected Pakistan for data collection because one the authors of the study has easy access to Pakistan, familiarity with culture and local languages, and he had practical access to SSDSs. The qualitative approach is consistent with the nature of current study because, first, it is a subjective approach which focuses on finding questions in term of “what”, “why” and “how” and secondly, it helps in understanding the objects in their environment in which they operate [11].

In addition to investigating the relevant literature, this study strongly needs to look into organizations and to understand actual PM practices in SSDSs. For this purpose we have used Grounded Theory (GT) methodology to determine what is happening in actual PM practices in SSDSs. This process involves development of codes associated with collected data, code categories, inter-relationship of code categories and their sub categories, and integration and refinement of theory. [17]

We have interviewed seven SSDSs in Pakistan, here anonymously labeled with the letters A through G; refer to table 1 for further information. From each SSDS, two relevant employees were requested to participate i.e. a project manager and a senior software developer. From Software Shop A and B we were able to access two interviewees i.e. project manager and senior developer, but from the rest of the SSDSs, we were able to manage only one interviewee i.e. project manager.

Table 1. Details about SSDSs and interviewees

<table>
<thead>
<tr>
<th>SSDSs</th>
<th>Total Employees</th>
<th>Expertise</th>
<th>Software Shop category</th>
<th>Interviewees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software Shop A</td>
<td>8</td>
<td>Web application design &amp; development</td>
<td>Project based</td>
<td>Project manager &amp; senior developer (PM &amp; SD)</td>
</tr>
</tbody>
</table>
Each interview was face to face with duration around 45 minutes. All interviews were recorded on a handheld smart device as audio files. The first two interviews were transcribed and analyzed prior to the subsequent interviews in order to improve questionnaire and interview technique.

Semi-structured interviews (open-ended) technique have been used to elicit data because semi-structured interviews provide a freedom of information (exploratory in nature) to the participant involved, it is flexible, and it provides opportunity for the interviewers' improvisation and exploration of the studied objects [9].

4 Project Management Practices in Pakistani Small Shops

4.1 Key Characteristics of PM Practices in Pakistani SSDSs

Through our analysis we identified six key characteristics of PM practices in Pakistani SSDSs.

- Many Intermediaries
- Non-Standard PM tools
- Customer Dictates
- Multiple Responsibilities
- No Access to the End User
- Lack of Project Management Training

4.1.1 Many Intermediaries

The companies get about 60% to 70% of their business from bigger software development companies operating in US, UK, and Australia. There was only one company who strives to get its business from the local Pakistani market. According to this SSDS, online business is gaining pace in Pakistan and has a bright future,
meaning more local business for the SSDSs. The other SSDSs perceives the Pakistani web market as immature and most business owners do not see how the web can benefit their business. They further added that the local clients pay too little for their websites.

The final or end customers of the Pakistani SSDSs who work for overseas clients are located in US, UK, Australia, or South Africa. They comprise a variety of on-line businesses; e.g. small online businesses, real estate business, online shopping carts, and social networking websites. Other clients are brick-and-mortar companies or individuals like barbers, designers, shop owners, reporters, and celebrities. The SSDSs in Pakistan and the final customer are however, isolated from each other by several intermediate layers: Often, the SSDSs, find their customers through online freelance portals/websites. The clients posting projects on these websites may be the final customer, but can also be an intermediary located outside Pakistan; e.g. in USA, UK or South Africa, who receives businesses from their local clients and so forth. Larger projects ($5000 plus) may be handled by another intermediate company who in its turn engages an IT consulting company (having excellent knowledge of web technologies) to prepare a requirements specification document (RSD), for one or more overseas web development companies like SSDSs in Pakistan. Thus, up to four layers may separate the end user from the SSDSs in Pakistan.

The chain may be even longer, however, since the Pakistani SSDS may choose to engage another local company to develop all or part of the project. Figure 1 illustrates the different trajectories and intermediate layers in this network.

The long chains result in delays in feedback from the end-customer to the SSDS. If a project has been delivered in two months, then the SSDS may wait for 2-3 months up to a year before the client returns with the end-customer's feedback.

![Fig. 1. Business layers between end-user and small shops in Pakistan](image)

In other cases, for very small web projects, either the clients approach SSDSs in Pakistan directly or a local (to the end-customer) intermediary outsources projects to Pakistan.
4.1.2 Non-Standard PM Tools

There is a long range of software development and PM tools available. These tools have been used throughout the whole software development life cycle (SDLC) i.e. PM, requirements engineering, design, implementation, and software testing. [1] In the case of SSDSs, the respondents claim that current standard PM tools do not fit their requirements. Project managers complained that the available PM tools are time consuming and complicated to use. They need a time efficient tool that can help managing around 20 small web projects simultaneously. Therefore, some SSDSs have studied four or five PM tools and have modified them to fit their requirements. By using these tools, the project manager can organize projects and tasks. He can communicate with developers and clients. He can instruct his developers about any task or project, clients can see status of their projects, the project manager and developers can upload and download files, and the tool also maintain history of all projects. There was only one interviewed SSDS that was using some features of MS Project tool and another SSDS using MS Team Foundation Server (TFS) to keep track of their projects.

4.1.3 Customer Dictates

In the project based SSDSs, the client often dictates project parameters; i.e. cost and duration of a project, and their feedback drives development activities. Customers control finalization of a project, they have access to PM tools at SSDSs to see the status and give feedback against their projects, and they have access to local developers and project managers and assign them tasks and dictate the process to be followed. One client, for example, has given Company F access to their online PM tool called PM Bubble. The project manager from Company F can get project details like number of tasks, project cost, start time, completion time, and comments about the project, and he is required to update project status through this tool. On the other hand, product based SSDSs have their online customer support system to get feedback from their customers/users and they don’t face customer dictation but they get new requirements, or bugs to fix.

4.1.4 Multiple Responsibilities

Most employees in the SSDSs have multiple responsibilities. Project managers also participate in software development, software testing, business development, and other managerial tasks. Software developers are also responsible for software design, and software testing. Some SSDSs give their clients direct access to the developers or web designers so that clients can give feedback on project status. In this way, clients do project monitoring and controlling of their projects that actually are responsibility of a project manager. Sometimes a client takes all responsibilities of a project manager and he considers SSDS as his development team. One of project manager told the authors that some of their clients outsource them front-end web development and website maintenance projects. For these projects, clients define task in an online
PM tool (i.e. PM Bubble) and give the project manager access to this tool to get project details i.e. number of tasks, project cost, start time, completion time, and comments about the project.

4.1.5 No Access to the End User

By 'end user' we here refer to an individual or a group of people who uses the final product. In some cases, a customer/client could be a user but if the product has been made for an open market then user and customers are different identities. [15] It is possible that client’s needs differ from those of end user’s needs. Therefore, it is very important to get input and feedback from end users during a development process [15]. The SSDSs in our study, however, are isolated from the end-user by several layers of intermediaries, as described above. In fact, they rarely even have access to the customer who originally ordered the product, but only to an intermediary, who, in his turn, may also be several steps away from the customer and end-user. In this way, project managers at SSDSs in Pakistan are sometimes unable to get real client input and feedback needed to run a successful PM process.

The many layers of intermediaries have economic implications for the SSDSs as well, since the client does not pay the SSDS until the final product is operational and approved by the original customer. This process, which may involve activities and components outside the control of the SSDS, can delay payment from anywhere between two months to a year. During this period, SSDSs may still receive requests for small changes and bug fixes.

4.1.6 Lack of Project Management Training

Most of our interviewees are the owner of their companies and they have a bachelor degree in Computer Science or Information Technology. They don’t have specific IT PM training or certification but have switched from being an experienced software developer to the role of PM. One young project manager even hasn’t proper education in computer science and he switched from in-process Chemical Engineering degree to software development. In the start he got expertise at Photoshop and other website designing tools and gradually he made it his profession by picking up projects from freelance websites. When he found himself more involved in these activities and he got business beyond his limits then he decided to open a company.

The project manager from Company E, on the other hand, has a Master degree in Software Engineering but he also started his career as developer and after five years of development experience he switched to PM. Normally all project managers at interviewed SSDSs don’t feel lack of PM training for their routine PM activities but when they get a bigger and complex project then they feel to make things formal. What makes project managers confident about running successful PM process at SSDSs; is their experience from previous projects.
5 Discussions

Our discussion and analysis based on the data collection from Pakistani SSDSs, and literature review, will be presented in two parts. The first part describes how well Pakistani SSDSs perform in the context of PM practices, and what kinds of challenges they face. In the second part, it is analyzed that what are the implications of key characteristics of PM practices in Pakistani SSDSs and what types of challenges they offer to SSDSs.

5.1 PM Body of Knowledge and PM practices in Pakistani SSDSs

In this section, we present the best practice benchmarking by considering six benchmarking indicators recommended by PMBoK i.e. Project Planning, Project Staffing, Project Execution, Project Monitoring, Project Controlling, and project closing as shown in Table 2. The purpose of this benchmarking is to learn how well Pakistani SSDSs perform in the context of PM practices, to evaluate why these small firms are successful or unsuccessful in the provision of quality software products, and as result of implications of this benchmarking; what types of challenges SSDSs are facing?

5.1.1 Project Planning & Project Staffing

The PMBoK represents a comprehensive set of project planning activities e.g. development of project plan, scope definition, collect requirements, estimation of time, cost, & resources, creation of work breakdown structure (WBS), risk management plan, quality plan, development of human resource plan, and so on. Besides PM planning processes, PMBoK has also given tools and techniques relevant to each project planning activity e.g. Expert Judgment technique for developing project plan, Focus Groups, the Delphi Technique, Brain Storming techniques for collect requirements process, Bottom-Up Estimation techniques for resource estimation, and Analogous Estimation, Parametric Estimation, and Three Point Estimation techniques for time estimation. [21]

Table 2 shows three columns describing PM process components from PMBoK in the first column, actual PM practices in Pakistani SSDSs in the second column, and anonymous references of SSDSs relevant to PM practices in the third column. Table 2 shows that for project planning & project staffing; most of SSDSs perform project estimations on the basis of their experience and not a single SSDS writes project plan document. Little less than half the SSDSs plan their project activities by using PM tools. There was only one SSDS which was using Three Point Estimation technique to estimate project budget and project duration. In all SSDSs, resource estimation is done on the basis of experience and they don’t make a plan for resource management. In most of SSDSs, tasks are assigned by informal mutual discussions and in some SSDSs project manager assign tasks/project on the basis of his familiarity with developer’s expertise or his experience form previous projects.
5.1.2 Project Execution

During project execution the project manager coordinates and integrates staff and other resources, and he performs project activities in accordance with project management plan. These activities may include changes to expected project duration, changes in resource productivity and availability, and changes in project plan documents to satisfy project objectives and customer’s needs. [21]. Table 2 illustrates that, during project execution process in most of the Pakistani SSDSs, project managers coordinate the developers by emails, informal face-to-face meetings, and whiteboards. In three out of seven SSDSs, project managers are also using PM tools to coordinate with their developers in accordance with project plan.

Table 2. PMBoK process components and PM practices in Pakistani SSDSs

<table>
<thead>
<tr>
<th>PM Process Components</th>
<th>PM Practices in SSDSs</th>
<th>SSDSs and their relevant practices</th>
</tr>
</thead>
</table>
| Project Planning & Project Staffing | a) Project manager keeps project plan in his mind but not on a paper or document  
b) Project Manager uses email and Skype history to maintain information about each project e.g. project time, cost, duration, client name, start and end date, requirements changes, and client’s comments & feedback against each project.  
c) Project manager use PM tool to plan the project management activities  
d) Estimations are done on the basis of experience  
e) Cost and time estimation by using Three Point Estimation technique  
f) Clients decides the cost, and project duration  
g) No project plan documentation  
h) Project manager estimate resources on the basis of his experience from previous projects and he also held short meetings with developers to estimate resources required  
i) Tasks are assigned by mutual discussions among project manager and developers | • Company A (a, b, c, d, e, f, g, h)  
• Company B, C, E, G (c, d, f, g, h, i)  
• Company D, F (a, b, d, f, g, h) |

| Project Execution | a) Project manager coordinate the software developers and other employees by using PM tool | • Company B, C, E (a, b, c, d)  
• Company |
b) Informal face to face meetings, emails and white boards are the means of communication among project manager and developers for project coordination  

c) Clients use PM tool to coordinate with developers at SSDSs  

d) Developers have access to PM tools and they can see any update regarding their tasks  

e) Major changes in time, cost, and resources are made if SSDSs get new but big requirements or big changes.

<table>
<thead>
<tr>
<th>Project Monitoring &amp; Controlling</th>
<th>G (a, b)</th>
<th>Company A, F, D (b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Project manager monitors and measures project progress by using PM tools and give their feedback to take corrective actions</td>
<td>• Company B, C, E, G (a, d, e)</td>
<td></td>
</tr>
<tr>
<td>b) Project manager monitors and measures project progress by walkthrough encounters, emails, and short meetings.</td>
<td>• Company A, D, (b)</td>
<td></td>
</tr>
<tr>
<td>c) Clients monitors and measures project progress by using their own PM tool and give their feedback to take corrective actions</td>
<td>• Company F (b, c)</td>
<td></td>
</tr>
<tr>
<td>d) Clients monitors and measures project progress by using PM tool provided by SSDS and give their feedback to take corrective actions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e) Developers have access to PM tools and they can see any update regarding their tasks</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Project Closing</th>
<th>• Company A, B, C, D, E, G (a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Project manager test and verify software product against the needs of a clients and then finalize product release</td>
<td></td>
</tr>
<tr>
<td>b) Client test and verify software product or a task (e.g. front. end design) and finalize the completion of a project</td>
<td>• Company F (a, b)</td>
</tr>
</tbody>
</table>

It has been mentioned in section 4.1.1 that clients/customers also take part in project management activities. For this purpose they coordinate with project managers at SSDSs, in some cases (company D,E), they coordinate directly with developers via their own online PM tools, by emails, Skype, or by PM tools developed by SSDSs. In these cases clients dictate project parameters; i.e. cost and duration of a project and their feedback drives development activities. They finalize the completion of a project, they have access to PM tools at SSDSs to see the status and give feedback against their projects, and they have access to local developers and project managers and assign them tasks and dictate the process to be followed.
PMBOK has mentioned sub processes of project execution process e.g. Perform quality assurance, acquire project team (confirming human resource availability), develop project team (of improving the competencies, team interaction), and distribute information (making relevant information available to project stakeholders as planned.). PMBoK has also provided tools and techniques to run these sub processes e.g. Quality Audits, and Process Analysis techniques for perform quality assurance process, Pre-Assignment, and Negotiation techniques for acquire project team process, and Interpersonal Skills & Team-Building Activity techniques for develop project team process. It has been noted during interview data analysis that there are a few techniques recommended by PMBoK, have been unintentionally practiced by SSDSs in Pakistan. For example Company C practices Pre-Assignment technique, Company A practices Three Point Estimate technique, and somehow all companies are practicing Interpersonal Skills technique for project team development. But the rest of preceding sub processes and techniques relevant to project execution, have not been practiced in SSDSs in Pakistan.

5.1.3 Project Monitoring & Controlling

In project monitoring and controlling (PM&C) process; project performance is measured and observed regularly and consistently to notice deviations from the project management plan. The PMBoK has given ten sub processes relevant to PM&C process e.g. perform integrated change control, verify scope, control schedule, control cost and so on. For each sub process of PM&C process, various techniques and tools are associated which help to run these processes. [21] For example Performance Review and Variance Analysis techniques for control schedule process, Inspection technique for verify scope process, and Expert Judgment & Change Control Meetings for perform integrated change control process. [21] If we look at table 2, it articulates that SSDSs in Pakistan are for away from practicing processes and techniques defined by PMBoK. In most of SSDSs, project managers monitor and measure project progress by using PM tools and give their feedback to take corrective actions. But in some SSDSs, project managers perform PM&C by walkthrough encounters, exchanging emails, and by holding short informal meetings.

5.1.4 Project Closing

Project closing process ensures and verifies the completion of all activities across all PM processes. To finalize the closure of a project, project manager can obtain acceptance by the customer/owner, conduct post-project review, record impact of tailoring to any process, or he can document lesson learnt. [21] PMBoK has proposed two sub processes for project closing phase i.e. close project, and close procurements. Techniques associated with these processes are Expert Judgment for close project process, and Procurement Audit, and Negotiated Settlement for close procurements process. It has been noted in table 2 that in most of SSDSs, project managers test and verify software product against the needs of a clients and then he finalize product release. Therefore it is acceptable that most of SSDSs are following Close Project
process and they are also practicing Expert Judgment technique to finalize project completion and to some extant SSDSs are also practicing Negotiated Settlement technique, because project managers often solve their disputes with by conducting negotiation sessions with their clients or customers.

5.2 Pakistani SSDS Challenges

The issues and challenges facing the Pakistani SSDSs have implications on their PM practices. The project managers’ multiple responsibilities keep them away from practicing thorough PM activities. They spend a larger part of their time in communication with clients and with developers and also take part in software development, and testing. Therefore, it is very difficult for them to develop and maintain project plans, systematically monitor progress, document activities or perform systematic project evaluation. In [24] it has also been reported the implications of multitasking by adding that assigning multiple projects/tasks to an individual enables companies to use developer’s expertise for different roles and for different types of projects. In this way, the company can reduce time and resources that are not in use. To show progress on all tasks and responsibilities; developers do work in time-sharing manner. But during this process; project completion is slowed down, time is consumed in learning things, forgetting, and then relearning. In case of the SSDSs, besides having many tasks/responsibilities, developers/project managers also have to deal with updates, defect handling from clients, and problem-solving meetings. Excessive multitasking for an engineer causes disruption and fragmentation in work, and it provides less opportunity for recuperation, and competence development. [24]

The Pakistani SSDSs are positioned at the very end of a long (global) software development chain where a task or project has passed through three to five business layers before reaching the SSDS in Pakistan. The many intermediaries create a communication gap between Pakistani project managers and developers, and the end-client/user. Information distortion in long - indirect - communication chains is known to result in ambiguities between clients and suppliers [26]. When a requirement from the end client, travels through all layers and reaches the project manager sitting in Pakistan, then it is not guaranteed that this particular change request is the same as the end client requested. In a similar way, if the project manager sends a mock up for a web page or a request for further information then the same problem occurs. It means that multiple business layers also do cause misunderstandings, and ambiguities between the end clients and project managers in SSDSs. Thus, the many intermediate layers impact the quality of a project. Delays in client/customer feedback also keeps the project manager from planning and performing further software development activities, thus creating problems for resource planning and project delivery.

The end-user’s involvement in the development process improves the chance of success of a project and its quality [15] but the SSDSs in Pakistan do not have access to the end users, only to the clients who pay them for a project.

In case of project based SSDSs; customers keep certain controls of PM responsibilities in their hands. Customers fix the cost of a project, they fix the duration of a project, their feedback drives the project development activities, they
have access to PM tools at SSDSs to see the status and give feedback against their projects, they have access to the developers and they can dictate them, and sometimes they dictate project managers at SSDSs to follow their own defined PM activities. In this way, the local project manager loses control over project planning, scheduling, project directing, and project controlling. We have mentioned above that 60 to 70% clients of SSDSs are big software companies and probably this attitude of giving dictations to SSDSs have been developed because the size of SSDSs is very small, clients knows that SSDSs are immature, and clients also know their financial limitations. But this attitude from bigger companies would make problem for project managers at SSDSs to be a confidant project manager.

Most of SSDSs that we interviewed don’t use standard PM tools; e.g. MS project. They find these tools complicated and time-consuming to use. Consequently, project managers at these SSDSs are facing omission of data, and rework issues because simultaneous they have many projects in running mode, and they have to deal with changes and updates for already delivered projects. Further each employee has multiple responsibilities which also contribute to make things messy. Therefore in this case, without PM tool support, it becomes difficult to keep track of information regarding each project. But on the other hand, two SSDSs have developed their own PM tools and these tools are exactly according to their PM requirements. The SE literature states that SSDSs have a perception about SPI standards that they are overly involved, complicated, missing detailed implementation guidance, and they require extra resources that would be additional cost to the company. [2] SSDSs are unable to afford the cost of extra resources and they don’t see any net benefit in applying software processes, models (CMM, CMMI) or standards (ISO/IEC 12207). [2] Therefore the trend of making existing SE tools, techniques, models, and SE standards according to the requirements of SSDSs should be promoted in SE literature.

All project managers at SSDSs in Pakistan have moved from software development to project management. They don’t have specialized training in PM and PM tool usage. Consequently they are unaware of PM methods and PM techniques, and they are totally away from current research in PM area.

The six characteristics of Pakistani SSDSs described in section 4.1 also have implications on project planning activities (see table 2). If we assume that SSDSs are following project planning activities as recommended by PMBoK, then due to multiple business layers (section 4.1.1), the issue of information distortion and ambiguity still remains there. This issue can cause major changes in project scope, cost, time, and project effort. Multiple responsibilities of the project manager are another factor which can keep them away from formulizing the project planning activities. Suppose if project managers are ready to give proper time to project planning activities then a question rises that do they have enough expertise for this? According to our study; most of the project managers at SSDSs don’t have proper training or certification in project management and it would be very difficult for them to follow planning processes recommended by PMBoK.

If we talk about the best practice benchmarking in context of PM practices in SSDSs then section 5.1 shows that, SSDSs in Pakistan are far away from practicing PM process and they are not ready to improve their PM process. This farness from real PM practices has stuck their growth and provision of quality products because
process improvement is very important for company’s growth and it plays major role in providing quality products [23]. This farness contributes to their problem of information distortion, omissions, project delays, less productivity, and weak quality. It also shows their trend and attitude towards practicing other SE disciplines like requirements engineering, configuration management, software design, and software testing.

6 Conclusions

Our results show that Pakistani SSDSs are facing many challenges related to PM in the local as well as global context. Locally they are facing challenges of multiple responsibilities, lack of PM tools that can fulfill their unique PM requirements, insufficient PM training, and unavailability of end-users who play important role in project success. Globally they have to face PM dictations from their clients (mostly software companies), they face many business layers to get business and to communicate with their clients regarding PM activities, and they are facing problems of information distortion, misunderstandings, incompleteness, delay in payments and delay in project delivery. These business layers also keep SSDSs away from practicing agile methodologies because agile methods purely focus on direct and face to face communication among individuals (customer-developers) that in case of most of Pakistani SSDSs, is almost impossible. [26]

The best practice benchmarking performed in section 5.1 has proved that the actual PM practices in Pakistani SSDSs do stay far away from PM practices recommended by PMBoK. Due to poor PM practices, SSDSs get stuck in their growth and provision of quality products. All project managers at SSDSs have very little knowledge with PM processes, tools, and techniques recommended by PMBoK in [21] that shows lack of interest in learning and adopting real PM practices, and it confirms that they don’t have proper PM training and PM education.

It is clear from above discussion that the Pakistani SSDSs share many of the characteristics previously reported from the publications of SSDSs in other settings. These characteristics include multiple responsibilities, short time to market, managerial crisis, ad hoc project planning, lack of documentation etc. [5, 3, 2, 25] We can assume that the commonality of these characteristics is a result of common structural and contextual properties of the SSDSs; e.g. financial limitations, narrow skill base, time constraint, lack of learning opportunities etc. what makes Pakistani SSDSs different from previously investigated SSDSs in other setting; is the long and complex software production chain. The overseas clients separated by possibly two to five intermediate layers have shaped a complex global software production chain arrangement (figure 1) and this arrangement has yields delays in communication between the SSDS and the end customer, ambiguities in the requirements, delays in payments, and it increases the risk of communication distortion.

These observations open further research into the exploration of additional global software production chain arrangements in other settings, their characteristics, and how these arrangements influence PM and software development process within the organizations in developing countries and also in global context. These observations
also motivate to conduct systematic comparisons between SSDSs in the developing and developed countries.

References

13. García, I., Suarez, L.E.: Determining Practice Achievement in Project Management using a Two-Phase Questionnaire on Small and Medium


Applying Scandinavian ISD principles in an African Context: Opportunities and Challenges

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Abstract. The new information and communication Technologies (ICTs) offers a great potential for well-being, education, and liberty for developing countries. However if the countries are unable to benefit from the new technology, problems will accumulate and they will get more behind - as it happened in Africa. Unfortunately, these countries have a vast need for the technology to develop their economies and living standards. We investigate opportunities of applying Scandinavian principles for ISD&I in the context of Africa, through analyzing and comparing two action research projects that have applied two classic approaches; The Trade Unionist (TU) and the Activity Theory approach. We focus specifically on the principles of participation, empowerment, and evolutionary design and discuss how they can help mitigate the challenges, create opportunities and exploit possibilities of ISD&I in this context. Based on this we argue how and why we think the Scandinavian approaches to ISD&I can be useful for the African context and in developing countries in general.\(^1\)

Keywords: Information systems development and implementation, Scandinavian principles, Participation, empowerment and evolutionary design, developing countries specifically African context

1 Introduction

The new information and communication Technologies (ICTs) offers a great potential for well-being, education, and liberty for developed and developing countries alike (Castells 1996; Kabamba 2008). However this crucial role of ICT’s in stimulating development is a two-edged sword. On the one hand, it allows countries to jump stages of economic growth by modernizing their systems, and they can increase their competitiveness faster than in the past (Bilas & Frank 2010). On the other hand, however the countries that are unable to benefit from the new technology, will accumulate problems and get more behind - as it happened in Africa (Castells 1996).

\(^1\) To the readers: this paper is under construction. There may be (many ☹) inconsistencies stemming from moving things around – we apologize for that. We would like you to help us develop the idea of the paper. How can we (from this paper “skeleton” provide solid ground for providing principle recommendations for African ISD&I draw from Scandinavian principles?
Although ICTs have the potential to accelerate development, enhance the effectiveness and efficiency of even the highest priority sectors of socio-economic development, such as health care, the global information infrastructure is creating gaps between the rich minority and the poor majority larger and wider than any other socio-economic and cultural phenomena in the history of mankind (Bilas & Frank 2010). For most African countries the digital divide and its implications has to do with their inability to deploy, harness and exploit the developmental opportunities of the emerging technological revolution and thereby advance the process of their socio-economic development Bilas & Frank (2010).

Organizational changes driven by ICT and involving information systems development and implementation (ISD&I) is highly challenging because of high complexity and heterogeneous stakeholders. The approaches and principles adopted are quite diverse and vary in different settings (Mursu et al. 2000). Avgerou (1995) emphasized the need to adjust ISD&I practices and approaches according to any given socio-economic, cultural and organizational context and different ISD principles and approaches have actually developed over the years in different parts of the world. However in most cases, IDS&I in Africa involve very complex processes influenced by several factors. The complexity is related to the complexity of the socio-political and economic context of the countries and notably the Sub-Saharan African countries. Prevailing conditions in these countries make it difficult for ISD&I approaches and methods to gain wider acceptance and application and research has shown an overweight of failing attempts of development through IDS&I in developing countries (Avgerou, 2008).

Scholars (such as Avgerou 1995; Braa 1997; Mathiassen & Sheepers 2000; Mursu et al. 2000; Korpela et al) have argued that, African countries could benefit from adopting some of the principles of sound systems development approaches in order to accelerate wider adoption, implementation and utilization of ITC’s in an effective way and but also that it is important to take the contextual factors into account when adapting western based ISD&I approaches and methods. They suggest that the Scandinavian approaches to IDS&I can be particularly useful in the African contexts.

The Scandinavian countries have introduced a variety of principles and approaches to guide and influence ISD&I practice and research that take into consideration the Scandinavian contextual values- like homogeneity, well-functioning traditions for handling negotiations and cooperation, and social democracy (Ivari & Lyytinen 1998; Mathiassen & Scheepers 2000). Compared to North American MIS tradition (which mainly focuses on positivistic approaches and objective empirical investigation), the Scandinavian traditions are characterized by their principles of “grass root” approaches as they emphasize IS evolution, user-participation, alternative process models, and they seek varying innovative theoretical foundations for IS and ISD. They also apply mainly anti-positivist and action oriented research approaches (Ivari & Lyytinen 1998, pp. 135).

The Scandinavian critical traditions are hugely influenced by the socio-cultural, economic and infrastructural climate of the Scandinavian countries. For example, the Scandinavian environment is characterized by homogeneity, an established legal framework, high level of technological infrastructure, flat organizational structure, high level of education and skills, and rich societies and still Braa (1996) argued that the principles of the Scandinavian ISD&I approaches could be applied in the contexts
of Africa since the values and principles involve local adaptation of IS, empowerment and the creation of local commitment and ownership through participative process.

So, the question is, if and how the Scandinavian critical IS&D principles influenced by the values of the homogeneous and non-hierarchical social structure of the Scandinavian countries, can beneficially be applied to inspire and influence IS&D practices in the African context with its heterogeneous culture and rigid bureaucracies. This paper aims at examining the opportunities and challenges of applying the Scandinavian principles of critical IS&D research in the African context. We are aware that IS&D principles and approaches that have been used in Scandinavian countries have been designed with a much more affluent and less constrained setting in mind than with many African contexts. The paper, therefore, aims to answer the following research question:

What are the challenges and opportunities of adopting critical Scandinavian ISD principles in the context of Africa?

To answer this, we have studied two IS&D projects (i.e. HISP2 and INDEHELA3) that have been working for more than a decade in introducing the Scandinavian critical approaches and principles to IS&D activities in many African countries. In order to ensure a solid foundation for our discussions and conclusions we analyzing the literature published in leading IS journals from the projects through content analysis of the actual texts based on an analytical framework we have developed around the Scandinavian principles of IS&D. The framework helped us for each project to display the IS&D context (including the economic, socio-cultural and infrastructural characteristics’), the values and principles that characterized the project in general and specifically as Scandinavian critical IS&D (emphasizing the principles of user participation, empowerment, and evolutionary ISD). Based on this rather rigid content analysis, we discuss how the findings can be interpreted to guide coming IS&D in the African context and in other developing countries as well.

The rest of the paper is organized as follows: section 2 provides an overview of the research context (more specifically the African socio-economic and technological environment), whereas section 3 highlights the Scandinavian IS&D principles and present the analysis framework. Section 4, deals with the methodological approaches adopted for this research and 5 deals about analysis and discussion of the findings, whereas section 6 provides concluding remarks.

2 Research Context: African socio-economic and technological environment

The Many scholars including (Castells 1996; Kahamba 2008) emphasized the potential for well-being, education, and liberty offered by the new information and

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2 HISP- Health Information Systems program:  www.hisp.org

3 INDEHELA- Informatics development for health in Africa  http://www.aku.fi/indehela
communication Technologies (ICTs) for developed and developing countries alike. The crucial role of information and communication technologies in stimulating development is a two-edged sword. On the one hand, it allows countries to jump stages of economic growth by modernizing their systems, and they can increase their competitiveness faster than in the past (Bilas & Frank 2010). On the other hand, however the countries that are unable to benefit from the new technology, will accumulate problems and get more behind - as it happened in Africa (Castells 1996).

Although ICTs have the potential to accelerate development, enhance the effectiveness and efficiency of even the highest priority sectors of socio-economic development, such as health care, the global information infrastructure is creating gaps between the rich minority and the poor majority larger and wider than any other socio-economic and cultural phenomena in the history of mankind (Bilas & Frank 2010).

Most African countries are generally classified as having comparatively less or inadequate access to modern ICT infrastructure and poor access to skilled manpower. But according to Bilas & Frank (2010), for most African countries the digital divide and its implications has more to do with their inability to deploy, harness and exploit the developmental opportunities of the emerging technological revolution and thereby advance the process of their socio-economic development. The conditions in the African context include poor infrastructure and unskilled manpower, different legal, cultural, political and social systems; different economic and technical realities; and individual and systemic powerlessness (Kiggundu 1984; Braa 1998). Besides, organizations in most Sub-Saharan African countries are managed as closed systems that are barely responsive to external changes (Kiggundu 1985), and they also exhibit dysfunctional modes of conflict management, inter group rivalry, little capacity for openness, trust and the rational expression of feelings, and well established hierarchical and social status barriers (Faucheux et al. 1982). These realities are still prevalent in most organizations of African countries.

Also the UNDP (United Nations Development Program, 2001) and the World Bank (through its Global Information and Communication Technology Department) back this view and argue that the need exists for developing countries to implement national ICT strategies to help them build ‘knowledge societies’ and foster development.

In contemporary development reports, the low diffusion of computers and telecommunications in desolate regions such as sub-Saharan Africa is used as one of the main indications of their plight (Avgerou 2002). Avgerou (2002) also note that “a closer look to consider the way such technology diffusion impacts on the economic, social, and organizational context of specific developing countries tends to reveal rather bleak pictures of ‘failed’ projects, and unused technologies often demoralizing rather than ‘enabling’ development”. So even though ICTs in business organizations around the world converge, the impact of their use may well depend on national culture and the specific characteristics of the economic and organizational environments in which they are embedded. ICT initiatives in developing countries in general and in African context in particular, are also typically characterized by poor infrastructure, inadequate human resources, and lack of an information culture and of basic computer literacy (Walsham et al. 1990).
Heeks (2002) pointed out the following challenges for the implementation and use of IS and ICTs in the context of developing countries:

- The technological infrastructure (telecommunications, networks, electricity) is more limited and/or older.
- Developing country organizations are more hierarchical and more centralized.
- Developing countries have less money.
- In addition, the cost of ICTs is higher than in industrialized countries whereas the cost of labor is less.

However, despite all the challenges listed above, there are indications that these conditions may be gradually changing, and many African countries have in recent years observed a strong increase of adoption of various ICT applications. For example, Spanos et al. (2002) argued that, while developing countries were reluctant to accept information and communication technologies (ICTs) in 1960s and 1970s, in recent years they have come to realize that “ICTs has come to constitute the basis of economic development both at the macro and micro levels, and hence those actors that fail to participate in such developments risk increasing marginalization” (Spanos et al. 2002). As a result, many developing countries are attempting to deploy ICT in various facets of governance. Bodvala (2002) for his part argues that the potential of modern ICTs for public sector application is being increasingly recognized and various developing country governments are in the process of implementing various initiatives ranging from telemedicine to the use of Personal Digital Assistants for data collection to the computerization of district health information systems (DHIS).

In summary the challenges in developing countries and especially in the African context are severe, however the potential of ICT’s to enhance and speed socio-economic development is increasingly recognized both at political and donor level of the countries, but the divide between how successful the countries are in engaging ICT’s appear wide.

3 Scandinavian Approaches to ISD&I

The Scandinavian schools of ISD&I include a plurality of specific approaches that vary to a large degree “in theories, research approaches, topics and outcomes”, but departs substantially from North American MIS tradition which mainly focuses on positivistic approaches and objective empirical investigation (Iivari and Lyytinen 1998). The Scandinavian approaches were established over 2-3 decades of IS research starting in the 1960’s when the socio-political history and dynamics of the Scandinavian society (Boland 1998), combined with a rapid and intense utilization of computers formed a fertile environment.

The approaches share common characteristic of being grass root driven and emphasizing IS evolution, of user participation and of alternative process models. They are also applying “dominantly anti positivistic and action oriented research approaches” (Iivari and Lyytinen 1998, p. 135).

Especially the critical research tradition of Scandinavian ISD&I has been influenced by the idea and values of democracy- within all spheres of life- including
the workplace. As such, the critical tradition rejects the harmonious view of social relations in work environments. The proponents of this tradition see organizations not as “cybernetic systems or symbiotic socio-technical systems, but as frameworks for conflicts between various interest groups with unequal power and resources” (Bansler, 1989, pp. 128). The critical ISD&I tradition that focus on job satisfaction and industrial democracy, that bear a conflict view and that emphasis opposing interests while thinking of labor force as individuals and group subjects tend to be the Scandinavian ISD&I approaches that depart mostly from the North American MIS tradition. Braa (1996) suggested, that the critical ISD&I tradition could become an interesting source of inspiration to inform and shape ISD practices at a local level in many African counties, being at true alternative to the often failed North American MIS tradition.

In this paper, we focus on four important principals of Scandinavian ISD&I as they are played out in the critical tradition; (User) participation, empowerment, evolutionary ISD&I and situatedness. We have chosen these four principles because we think they offer opportunities for ISD&I in the African context.

By **user participation** we mean “the involvement of users in work activities during systems development” (Bjerknes and Bratteteig 1995). This participation can have different degrees of involvement ranging from representative to direct collaboration and of different degrees of influence on the design decisions. The focus on user participation that is widely shared among the Scandinavian ISD&I schools, becomes most radical and innovative in the critical tradition. The fundamental understanding of opposing interests between capital and labor and of organizations as having inherent conflicts demands increasing work democracy and ensuring “the members of an organization the right to participate in decisions that affect their work” (Bjerknes and Bratteteig 1995). Designers and researchers have to arrange for fair and open possibilities for labor force to participate in the design processes to reach acceptable alternative solutions. The participate ideal aims further than improving the knowledge base for building the information system or than ensuring matching of expectations. Among the approaches that carry this tradition are the Collective Resource approach, (Ehn and Kyng 1987) designing to increase democracy and skills, and the Trade Unionist approach (see below).

By **empowerment** we mean to increase the ability of someone or some group of people to influence something they want to influence. Often they gain more power to take control of their own lives. Empowerment applies both to the aims and the means of ISD&I in the Scandinavian tradition. As mentioned above members of an organization should be given a high degree of influence on the design process and decisions, thus having the power to influence their own work. But also the resulting ICT should help empowering individuals and groups of powerless people. Some schools of Scandinavian ISD&I have a strong knowledge interest oriented towards “emancipation from seemingly “natural” constraints through free and open communication” (Iivari and Lyytinen 1998) while others merely aims specifically at work democracy and job satisfaction.

The idea of **evolutionary ISD&I** is widespread in the Scandinavian ISD&I schools, based on the belief that organizations and communities develop continuously through learning and new knowledge (Iivari & Lyytinen 1998). The continuous learning and change demand evolutionary ISD&I where the information system is
developed through continuous iterations from evolving requirements. Often practiced as grass root initiated and driven ISD&I, this should be seen in opposition to centralized top or management driven ISD&I. The research efforts leading to these approaches were often initiated by rather small groups of people that had alternative ideas for (the development of) the information systems and the power to carry the necessary research out, sometimes even against resistance.

On top of these principles we add the observation that many approaches and the differences between them often is resulting from situatedness. They develop through research as answers to specific situations in which they were developed. Differences in the technological, organizational, and societal challenges meeting and surrounding each research stream, lead to different and situated approaches. This ability to embrace and accept of the need to adapt each approach to the situation (instead of vice versa) we find rather evident and unique for the Scandinavian ISD&I schools and we bring it to our framework under the label of situatedness. It covers the willingness to adapt ISD&I approaches to the situation at hand in the organization, the industry, and the community taking into account concrete challenges, possibilities, community traditions and worldviews of participants (including the researchers).

The principles are all interrelated in different ways. To succeed in participation the approach has to be situated or at least suited for the participants. Situated and (critical) participative approaches support empowerment often more so when evolutionary, since the learning of the participants can enhance both the process and products developed through the effort etc.

4 Methodology

In order to investigate the challenges and opportunities of adapting (critical) Scandinavian ISD&I principles in the context of Africa, we have studied two major Scandinavian research projects doing exactly that. We base our discussions of the question on a qualitative content analysis of publications from the research projects in focus. Qualitative Content analysis is a research method that provides a systematic and objective means to make valid inferences from verbal, visual, or written data in order to describe specific phenomena (Weber 1990, Downe-Wamboldt 1992, Burnard 1996, Elo & Kyngas 2007). We have applied the basic principles of qualitative content analysis to the contents of published case studies from each of the HISP (Braa et al 2004, Braa et al. 2007, Braa & Hedberg 2002) and INDEHELA (Korpela et al. 1998, Korpela et al. 2002; Mursu et al. 2007) projects that were published between 1998 and 2007 in highly influential IS journals. We developed an analytical framework from the principles of the Scandinavian ISD&I approaches described above. The framework ensured a systematic and through analysis of how the principles played out in the projects, as well as provided basic descriptive data (project economic, socio-cultural and infrastructural context, project characteristics and values (worldviews) behind).

The main dimensions of the framework correspond to the predominantly characteristic of the Scandinavian approaches; ‘user participation’, ‘empowerment’, ‘evolutionary ISD&I’, and ‘situatedness’. This is in line with the preparation phase of
content analysis which starts with selecting the unit of analysis (be a word or theme). For each dimension or aspect the opportunities and challenges of adapting (critical) Scandinavian ISD&I principles in the context of Africa were explicitly addressed.

We analyzed the available data iteratively. First each of the authors focused on one of the studied projects reading and marking the texts in accordance with the framework, followed by analytical thinking aiming at pin pointing the opportunities and challenges that the data (text) about each project displays. Then the studied projects were swapped between the researchers reviewing the first analysis. Eventually the two partial analyses were compared to identify differences and shared aspects as a basis for discussing the possible opportunities and challenges that applying Scandinavian ISD approaches in African context could provide.

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4 This last part of the methodology we have to admit are “research in progress”, so the following discussions are based on first iteration.
5 Findings

In this section we provide summaries of our findings from the analysis, that we base our following discussions on. One sub-section pr. analyzed project.

5.1 HISP: The Scandinavian principles taken to the limit and beyond

Researchers from the University of Oslo initiated in 1996 a project called Health Information Systems Program (HISP) starting with a project South Africa. The idea of HISP was that despite the differences in country context the Scandinavian ISD approaches offer important lessons for African IS development practices (Braa, 1996). The first initiative was suggested by a strategic management team formed to plan the reconstruction of the health sector of South Africa post-apartheid. The project was founded in three health districts, funded by the Norwegian Agency for Development CO-operation and based in two local universities, too. The aim was “to identify information needs and to engage the end-users and local management structures in the process of developing new health information systems” (Braa & Hedberg, 2002).

The main focus was standardization through development of shared essential data sets and of new district health information software. Many of the challenges were due to funding, to gaining support and to handle the differences in the contexts of the new IS. The developed software was free, open, flexible and adaptable to other settings, which resulted in a country roll out of the system, with possible adoptions of the systems to all the local contexts, while still ensuring the standardized datasets.

The project has been further spreading and is now currently ongoing in a number of African and Asian countries including South Africa, Tanzania, Malawi, Botswana, Ethiopia, Nigeria, Sera Leone etc) and have given opportunity for research of the project(s) also to focus also sustainability of the systems and on networks of ISD and development. The spreading is facilitated by the openness and adaptability of the free software that was developed in the early projects in African. The software is further developed and adapted through prototyping in each of the ongoing projects.

HISP started as part of the reconstruction project of the health sector of South Africa, that were striving for equity in health care sector based on a decentralized structure of health districts. Empowerment was explicitly inherent in HISP (Braa & Hedberg, 2002 p. 113). Also many of the early actors were former political activists and the researchers (at least the Scandinavians) regarded themselves as political actors throughout the project (Braa & Hedberg, 2002 p. 114). The aim of engaging and empowering the end-users and local management was reached through wide spread participation and an active education and learning strategy.

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5 This section is the least matured text and may be difficult to read and can appear somewhat decoupled from the rest – sorry.
The ISD process is characterized by the researchers as cultivation, “by which they mean a slow, incremental, bottom-up process of aligning actors by enabling translation of their interests and gradually transforming social structures and information infrastructures where the resources already available forms the base.” (Braa & Hedberg, 2002 p. 116) This concept of cultivation indeed describes an evolutionary ISD process, but compared to more well-known examples of evolutionary ISD from Scandinavia, this is more inclusive, slower and focused on the process as in opposition to the product. Braa (1998) call it a learning approach with process oriented perspective and Braa and Hedberg (2002) emphasis the role of negotiation in the ISD.

The participation in the projects spans traditional user participations in work-focused design and prototyping process (Braa & Hedberg, 2002, p. 122) e.g. sessions of evaluation of the existing data collection forms (Braa et al. 2004, p.350) and the involvement of the broader range of stakeholders in negotiations of decision. Both kind of participations played important roles in the balancing act of standardization and local flexibility that the researchers of the project carried out. The classic user participation brought the needs of the local health care works forward and displayed the differences between the local settings, while the broader negotiations emphasized the need for standardization.

This explicit and open balancing act led the researchers to develop the multilevel cultivation approach which is a true example of a situated approach (Braa & Handberg, 2002 p. 126). Cultivation as described above is based in the uniqueness of the situations and ensure adaption to what is there already (bricolage) and to what can be negotiated, while the unforeseen challenges and possibilities throughout the process sparks improvisation targeted the unique situation (Braa & Handberg, 2002, p. 116). The red line through all of the HISP projects are the adaptability of the IS and ISD processes needed to situate and localize the solutions that are already there. This ability of HISP to adapt to new situations is very visible in Braa, Monteiro, and Sahay, 2004, where they display the commonalities and differences between the local projects and explains (for some of them) how and why the adaptations happened (see table1,3 and 4 from the paper).

HISP adopted a multi-dimensional perspective to health information systems development, acknowledging the complex interplay between individuals as social beings, and technology as a dynamic and rapidly changing field influenced by huge range of factors, many of which are the control of any single individual. Given this understanding the challenges in many African countries is not to develop an appropriate IS, but to be able to scale the system and sustain it in a context characterized by poor infrastructural access, inadequate human capacity, heterogeneous actors, multiple institutional practices, and rapidly changing work settings.

For example, the case from South Africa revealed two important aspects of participation: reliance on the tradition and culture of participation in communities as well as ensuring that the key role players (multi-leveled and multi-sectorial) participated. The case material revealed that the participation was in line with traditional and customary traditions where decisions are made collectively (based on principle of Ubuntu collective personhood and collective morality).Traditional communication channels were used for data collection and feedback of information.
The Indian case typifies efforts to foster participation in hierarchical settings. They argue that in starkly different historical, political and social contexts such as India, participatory processes will not arise naturally as a result of democratic aspirations or reasoned argumentation, as may be the assumption in formal workplace settings of western countries like in Scandinavia or the UK. Paradoxically, however, participatory processes often need to be initiated by government official’s in-charge, rather than these emerging idealistically from grassroots as a bottom-up process. An implication, therefore, is that to enable participation in settings that are traditionally hierarchical and non-conducive to self-initiated bottom-up processes, the initiative may need to come from the top, and then be gradually nurtured over time. In the Mozambican context, the mediating role of the academia lay in acting as a bridge between health bureaucracy on one hand, and the communities and the local health workers on the other. They also mediated between the policy formulated by national/state governments and its translation into concrete practice on the ground. The role of mediation played by the academic members of HISP was critical in creating the required environment for learning by doing. User participation means not only users participating in design but also designers participating in use. The designers should try to share practice with users. Participatory design is a learning process in which designers and users learn from each other and the users, in particular, must have a guarantee that their design efforts are taken seriously.

5.2 INDEHELLA: The Scandinavian principles taken for granted

Researchers from University of Kuopio in Finland in collaboration with a research group in a local university in Nigeria attempted a made in Nigeria type of ISD methodology in a project called INDEHELA-Methods (Korpela et al 1998). They criticized the conventional participatory approach for its primary focuses on the immediate users, and for not giving attention to issues of wider socioeconomic justification or sustainability. However, they argue that elements from various participatory approaches can be adjusted and combined, based on a shared philosophical and pragmatic orientation, in order to develop ISD methodologies which fit the constrained conditions in Africa (Korpela et al. 1998, Korpela et al. 2000, Musu 2002). As such, Korpella et al. (2002) identified the following five criterions to develop more appropriate ISD approaches and methodologies in African context:

- ISD methodologies in Africa must be highly practicable to be used by systems developers whose education is limited and who work under severe financial, infrastructural, administrative and time constraints in projects with relatively scarce resources. Rapid, informal, and flexible methods are better than tedious, formalized and rigid ones.
- The methodologies must ensure that the resulting information systems have high socio economic impact in comparison to the resources invested in them.
- The methodologies must pay much attention to ensuring the long-term sustenance of the resulting information systems in financial, organizational and technical terms.
The methodologies must mobilize wider social forces to push the ISD projects through and sustain them in a harsh environment as well as to safeguard the socioeconomic impact. Taking management and local communities as the most important stakeholder groups, in addition to system developers and IS users. Flexibility of methodologies is also essential.

- Draw from local tradition, i.e. to search for such aspects of local traditional culture and values which are conducive to ISD, and to harness them intentionally.

Based on the above criterion, they selected participatory methods (including Activity Analysis and development, Cooperative design, and MUST) from the Scandinavian approaches and tested their applicability for ISD in African context in general and for Nigeria in particular.

Primarily, the INDEHELA project information systems development (ISD) was studied as a work activity. ISD as a work activity was studied by using the Activity Analysis and Development as a framework. The focus was on the work activity of information systems development, not just individual, group or organization, but all the elements of the activity, like object, outcome, process, actors, collective actor, means of work, means of coordination and communication, and mode of operation.

One interesting finding from the INDEHELA project with regard to ISD in Nigeria context was that the work does not differ much from the industrial countries, when it comes to technology or software engineering. The main differences were found from the socio-economic and infrastructural context of the country. To address problems related to socio-economic and infrastructural issues, the INDEHELA project emphasized the importance of taking into account some special requirements (or principles) during the ISD process, but which are not sufficiently dealt with in ISD methodologies in Nigerian context.

The first issue is sustainability of the information system. Korpela et al. (2000a) argue that in order to fulfill the expectations of the information systems as a tool for development, these systems should be sustainable. Particularly in a less affluent country, the long-term viability of information systems is essential, but the required infrastructure and support activities are often lacking. The development process and methodology should consider the appropriateness of the technology to the application environment and the availability of the local technological capacity to sustain its beneficial use. The issue is that the new system would not be abandoned when the development project has ended.

The second issue is affordability of the social information system and the new technology used within it. Information technology is still quite expensive an investment for companies in Africa, so it is important that the scarce resources are not wasted. The benefits must exceed the expenses, and the organization must be able to afford to cover the running costs, maintenance, and further development of the system in the long run. Thus the technology must be suitable for both users and developers, and the application must be adapted to the actual conditions. The existing information system must afford the changes caused by the new technology. For example, it can be risky to follow the latest technological trends, even if it can be tempting (Mursu et al. 2001).

The third issue is the ethics and socio-economic justification of information technology. Korpela et al (2001a) noted that Information systems cannot just make
life easier for immediate users, in particular in a less affluent country. However, although information technology cannot directly influence high-priority issues like health, education or agriculture, it should have an indirect multiplier effect. For example, computers do not cure the diseased or feed the hungry, but they can make healthcare delivery more efficient, more accessible, and more focused (Korpela et al. 2000a; Korpela et al. 2002, Mursu et al. 2001).

In order to successfully address the issues of sustainability, affordability and ethics and socio-economic justification of technology in resource constrained settings of African countries, the INDEHELA project on the importance of user participation in the process of ISD. It could be assumed that organizational barriers, economic hardship and the general insecurity of life creates obstacles for cooperation in developing countries, but the experiences by Korpela et al.(1998) in Nigeria indicate that participation and cooperation are not only possible in a deprived African country, but a must. They conclude that a computer-based system will not survive the harsh socio-economic conditions without the dedication of its users. Dedication begins by having users involved. Bringing users into the development process alleviates problems like computer phobia and fears and thus increases the user organization’s technological capacity to sustain the system and reach a positive socio-economic impact.

However, Korpela et al. (1998) argued that the scope of participation should be expanded from designers and users to the communities. More specifically, drawing from the experiences an information system project at a university teaching hospital in Ile-Ife, Nigeria, Korpela et al (1998) pointed out that for primary health care (PHC) information systems design, tripartite participation is required – a partnership between designers (computer personnel), users/providers(healthcare personnel) and community representatives. The essence of such tripartite partnership is that when the designers and developers, local government authorities and communities work as partners in a project, this encourages capacity building (i.e. empowerment of local or indigenous communities with information and skills needed to carry out specific activities), a sense of ownership and sustainability of the project when the donors leave (ibid pp. 341). They also argued that the full participation of all parties in PHC projects is dependent on how three basic steps or activities are managed: (i) entry into community, (ii) capacity building, (iii), and project implementation.

6 Analysis & Discussion

We have described three (four) key principles that characterize the Scandinavian critical ISD&I tradition and analyzed two concrete applications of them in African context. We now discuss their potentials to be adapted in the context of economically deprived African contexts. The question is how the Scandinavian critical ISD principles of participation, empowerment and evolutionary IDS&I shaped by the values homogeneous and non-hierarchical social structure of the Scandinavian countries can possibly be applied to inspire and influence ISD&I practices in the African context with heterogeneous culture and rigid bureaucracies traditionally run by the authority of superiors rather than the initiative of employees?
6.1 Applying the Scandinavian ISD&I principles in African context

Our analysis of the literature from both HISP & INDEHELA projects revealed that, despite severe socio-cultural, economic and infrastructural constraints in developing countries in general and in Africa in particular, the principles of participation, empowerment, evolutionary ISD&I and situatedness was successfully adapted to local contexts, but that the challenges of the local contexts pushed the principles to and beyond their limit.

Whereas in Scandinavia the principle of participation is mainly characterized by a workplace focus recognizing that it is ethically and morally right that workers should be involved in the development of systems which are to affect their working lives; in the context of Africa, the focus has been on community participation and empowering deprived communities through learning (see for example Braa & Hedberg 2002; Korpela et al. 1998). In the African context the principle of democracy in ISD&I have to reach further than just workplace democracy. It needs to span the local community, since the sustainability of the information system depends on how ready the community is to embrace the change brought by the system. This in turn demands more from the participative principle than usual in the Scandinavian context, where there is a tendency of rather few participants representing “the users” in the design process to ensure high quality designs adapted to the actual use – and in the critical tradition as means for empowering the users to influence their own work day /life. In the African context however participation in order to ensure good solutions cannot count on high and evenly distributed skill and knowledge level among the users and influenced citizen’s. Thus the participation will also have to ensure an appropriate skill and knowledge level in a broader community as part of a good solution – or at least an adopted /accepted solution. The methods and ideas for participation invented in Scandinavia still applies for the actual design, but needs to be supplemented in order to involve broader communities in mainly the decision making processes. The need for broader involvement has been less researched in the Scandinavian approaches but has been addressed in the MUST method (Kensing et al. 1998).

In the context of HISP, for example, the principle of participation has been adapted to involve economically deprived communities where the majority might be without formal employment. The community is generally seen as a key level for social development. Such development will rely upon community participation in decision-making for social development at a local level (Braa 1998; Braa et al. 2004; 2007). Braa (1998) put forward two rationales for using the community based participatory design approaches in the context of Africa and third world in general:

- It is community perspective, a strategy to enhance both the communities as well as prepare technical development that goes beyond mimicking the Scandinavian tradition.
- A bricolage perspective, a strategy to base system development on the potential given by the situation, context and resources available in a bottom-up approach. This is a pragmatic third world perspective, a functional way to get things working despite lack of the resources and network support that are taken for granted in the first world.
In the context of INDEHELA, Korpela and his associates from Finland and Nigeria also emphasized the importance of community participation through action research to ensure the sustainability of ISD&I initiatives in African contexts. They argued that participatory approaches and more importantly community participation in ISD&I in Africa is even more important than in industrial countries, since it alleviates problems such as computer phobia and fears and thus increase the user organization’s technological capability to sustain the system and to bring positive socio-economic impact (Korpella et al. 1998; Korpella et al. 2002; Mursu et al. 2007).

Empowerment always brings relative de-powerment elsewhere. The notion of power struggle between capital and labor provide a basis for the (critical) Scandinavian ISD&I principle of empowerment. In the African context however, this may also be at stake, but the most evident power struggle is between the central, well-educated and richer areas/ authorities and the less educated and poorer regions and local authorities. Traditionally global awareness is on the central authorities and the international founding goes to and is distributed through these. In this light the empowerment principle needs to be refocused to another power balance, yet the methods, techniques and ideas usually applied will still be useful. Through participation, learning and funding to local projects the less powerful parties (local) needs to regain power in comparison to the centralized power.

Viewing ISD&I as evolutionary and being grass root initiated and driven was rather early part of the Scandinavian principles (see Iivari & Lyytinen 1998). Still the ISD&I processes tend to be viewed as well-defined projects among known stakeholders, with rather clear goals of developing and implementing an information system and thereby changing the organization. This somewhat well-orderedness however does not apply in the African context. The ISD projects here are often shorter lived and narrower defined than the usual Scandinavian action research projects, since it is very likely that the communities lack resources to ensure sustainability when the external funding of the projects ends. Thus the principle of evolution needs to be extended across project periods and the grass roots principle needs to be strengthened in to a networking principle actively involving outsiders in the grassroots network of the ISD&I during the periods of funding, attempting to ground the effort so that they can be sustained also through the more difficult periods.

Because of the lack of experience in information technology and information systems development in the African context (see Odedra 1992), IS designers have high level of uncertainty regarding both the context of the systems development, the goals of the system and its future use (see Davis 1982). In such situations, Davis (1982) suggests evolutionary and experimental approaches (through user involvement and participatory prototyping) as appropriate approaches to systems development.

The evolutionary prototyping approach to ISD adopted by HISP helps to secure adoption and use of the system while also reducing development costs (Shaw & Braa 2010). The main objective of the evolutionary prototype approach is to empower local users so that the end users will be converted to become advocates of the system. The result has been that the HISP network has seldom initiated an ISD&I project on the basis of systems specification- rather it has been through a process of small-scale, bottom-up start-up modifications and adjustments depending upon existing local needs. HISP’s approach takes in to account the fact that if the new systems are too complex, then it is likely that they will be rejected as inappropriate, but small changes
that build towards a bigger vision has a much better chance of being accepted (Shaw & Braa 2010; Braa et al. 2004). According to Shaw & Braa (2010), this creates an environment whereby systems development processes interacted with the scaling process in an interactive manner.

6.2 Opportunities and Challenges of Applying Critical Scandinavian ISD Principles in African context

In the previous section we discussed how the Scandinavian ISD&I principles was applied in the African context. In this section we address research question, which deals about identifying the opportunities and challenges of applying those principles in African context. Indeed, there are conflicting views with regard to the potentials of the Scandinavian principles. For example, Agerou & Land (1992) claim that in addition to political and economic obstacles, the traditional cultures of developing countries are also hostile to applying the principles of participation, while Greenbaum (1993) regard traditional culture as a potential “indigenous opportunity factor” rather than as an obstacle. Our analysis of the literature from HISP and INDEHELA projects conform with the view of Greenbaum’s (1993) seeing local culture as an opportunity factor. Of course we acknowledge the differences in context and the need to adapt some principles to be aligned with local cultural values and traditions. For example, as Puri et al. (2004) noted, that in most developing countries, cultural practices are deeply embedded in the ethos of the community, and that the participatory paradigm in these settings is bounded by the cultural traditions and practices. Ritual and ceremonies are the events to assert unity and harmony of the community. It is through these mechanisms that social fabric of a community is constructed and value systems to nurture common good are developed and find expression (ibid, pp. 48). Therefore, combining local cultural values with the principles of participation, empowerment, evolutionary ISD&I and situatedness is an opportunity that needs to be explored. For example, the principle of participation can easily be combined with the South African traditional and customary values where decisions are made collectively (based on the principle of Ubuntu – collective personhood and collective morality).

With regard to challenges, one prominent challenge faced by many developing countries is to sustain information systems at a local level after the system has been designed and implemented with financial and technical support from international donor agencies. As Mursu (2002) noted, especially in less affluent African contexts, the long-term viability of information systems is essential, but the required infrastructure and support activities are often lacking. This poses a big challenge to fulfill expectations and sustain its operations. Thus the development process and ISD&I approaches should consider the appropriateness of the technology to the application environment and the availability of the local technological capacity to sustain its beneficial use (ibid).

Braa et al. (2004) in their part address sustainability as the major threat for ISD&I initiatives in many sub-Saharan African countries. They inform that, shaping and adapting technological systems to a given context, cultivating local learning processes, and institutionalizing routines of use that persist over time (even when external economic and technical support is over) has been the biggest challenge in
HISP initiatives in many African countries. Similar challenges of lack of sustainability of apparently successful projects have also been reported in the critical Scandinavian ISD&I tradition (such as the UTOPIA project, see Bjerknes et al. 1987). Bra et al. (2004) argued that, in the context of African countries with poor economic, infrastructural and skilled manpower records, the problem of sustaining ISD&I interventions should be addressed through ongoing and continuous translations around the vertical (local appropriation) and horizontal (diffusion) axes. The translation perspective have been illustrated through the standardization of data collection and reporting tools in many HISP nodes including south Africa by introducing the principle of hierarchy of standards to forge compromises between variations in local requirements (Braa et al. 2004, pp. 355). Another example of building sustainable ISD&I initiatives from HISP comes from their approach for training and education (ibid).

5.3 Mapping the Scandinavia principles to traditional (action research) projects – or why negotiations and learning are key activities*

As noted before the principles of Scandinavian ISD&I are of course intertwined and do interact when parts in a real IDS&I project and also our findings from the projects are connected to a whole by being part of real ISD&I practice and research project. From the findings it became evident that the principles played roles of varying importance during the lifespan of the projects (a finding we had not expected). To illustrate this we have mapped the principles as they played out in the projects onto Mckay and Marshall’s description of action research. We have chosen this generic description because it covers the full learning and action circle for both the ISD&I and action research practice and thus fits the studied projects well (see fig.)

Left part of the figures shows the ISD&I actions of the action research project, while right hand side og the figure show the aligned research aspects of the project. We found that the principles had varying roles and varying importance in the two parts of the action research project over the lifespan. This could imply the need for taking this into account when applying the principles. Below we present the findings as displayed in yellow in the figure and suggest how take action on this basis.

First; it was evident that the notion of empowerment, emancipation and democracy were important points of orientation in both identifying the research themes and the actual problems to address. HISP for example was initiated with the explicit idea of reforming the outdated oppressive and unfair apartheid solutions to healthcare in South Africa. This was the interest of both the healthcare organization and the researchers thus important for the outset of both learning cycles of the framework.

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* This section is a bit experimental. We do think that conclusion from the section are important, but struggle with how (and where in the paper) to bring them forward.
Second; when finding facts about the problem, the stakeholder’s notion of a fact especially of an important fact is influenced by the worldview of the participants. If belonging to the critical schools of Scandinavian IS&I your notion of organizations as frames of conflict full of inherent opposing interest, will influence what information is regarded as relevant and important. The worldview of the research projects was somehow brought to the projects by the Scandinavian researchers, and if this worldview is only partly shared by the rest of the participants negotiating facts can be a central point for alignment and learning.

In the HISP network, negotiation between different stakeholders played a major role. There are always negotiations at the political level and at the user’s level. At the political level, the negotiations are between national, regional or district officials on how the technology is to be implemented and what values it can bring at different levels. At the user level, the negotiations are between IS designers and end users on the specific functionality of the system, on skills and knowledge required to use the system, and in co-development of the system through continuous negotiation and collaboration.

When basing the action research on the critical Scandinavian IS&I principles, the action circle of course becomes focused on ensuring participation as a driving factor of the action and as a key means for the researchers to achieve their empowering goals.

In HISP, this was played out as empowerment by learning and the amount of participants learning could is key to sustain the effort and actually improve the abilities of a community.

In the planning of the action circle, situatedness plays an important role. Whether the planners understand the world as fluid and IS&I as evolutionary or sequential is crucial for the planning. This is the most important activity in adapting the principles and approaches to the local context. Researchers and local participants both have to
contribute in this to ensure that local challenges are handled and especially opportunities are used.

Both projects displayed willingness to adapt their approaches and solutions to the situation at hand and they put emphasis on rooting the ISD&I in the local context. Acting and implementing solutions is played out in an understanding of this process as structuration. This stresses the need for negotiation, iterations and good communication as part of an evolutionary approach to new solutions. The action and implementing needs to be intertwined with the planning and re-planning as an integral part of the action since the local situations at hand is less known by the researcher on one hand. On the other hand the principles and approaches are less known by the other participants, which in turn leads to more misunderstandings, but also to more innovations/new ideas/improvisation.

The learning and evaluation are of course again influenced of the goals of the effort, being based on the values of empowerment and democracy as well as just being plain useful. Compared to the Scandinavian application of these principles the benefits of the ISD&I in the African context may need to be evaluated broader since the full communities need to be empowered and lifted by learning. The solutions will certainly have to be evaluated in (a very broad) context.

So when bringing the Scandinavian principles of ISD to the very different context of Africa – or in general into context differing from the original context of the principles and approaches, the initiating phases of the action research have to be extended with negotiating, agreeing on and internalizing these grounding principles by the rest of the participants of the collaboration. In some projects the principles are more clearly outspoken (in HISP the core principles was part of the project goal) than in other projects, but the explicity is crucial in order to reach sustainable results of the efforts. This actually gives the fact finding phase a more important role than usual, as the opportunity to negotiate and commit to the grounding principles or a shared worldview for the ISD.

Another aspect seen especially in the HISP project is that it takes more than what is in traditional action research to ensure sustainable benefits of ISD&I in Africa (and maybe also in Scandinavia, since at critiques has been that the research project have rarely had sustained impact on society). As described above we have seen that in order to reach and sustain empowerment, have a better solutions adopted and being able to sustain and diffuse the results in a longer term perspective, the principles will have to be extended beyond the traditional boundaries or scope of the research projects. This calls for even further negotiations and learning of these basic principles.
3 Conclusion and Implications

In this paper, we analyzed the contents of selected publications from two action research based projects (HISP & INDEHELA) that have been working to apply the critical Scandinavian ISD principles in African countries in particular. Contrary to some doubts (Avgerou & Land 1996), our analysis demonstrated that the principles of participation, empowerment, evolutionary ISD & I and situatedness are indeed important even in the severely constrained settings of African countries. However, we have also noted that those principles have been modified, and translated to fit their new socio-cultural, infrastructural and economic context. As Puri et al. (2004) indicated there is very little that would apply universally, and the specific promoters and inhibitors of the principles vary even from country to country and even from organization to organization. For example, unlike Scandinavian countries where there is universal access to ICT infrastructure and facilities, in resource constrained African countries access to technological infrastructure are distributed from the center to the periphery unevenly in a manner that reflects the socio-political imperatives and economic realities of the African countries. Besides, the critical Scandinavian principles to ISD & I are results of the socio-cultural values of the Scandinavian society including work place democracy, equality, sense of solidarity, mutual dependency and fairly intense and causal cooperation at all levels of societies. On the contrary, the socio-cultural setting in African countries is characterized by complex hierarchies, over politicized decision-making process, bureaucratic complexity, commitment to personal gains…etc. Such issues should be taken into account when the Scandinavian principles are taken to the new setting. For example, the principle of participation in the context of Scandinavian countries has typically explored ISD in single organizational contexts, and rarely in community-based and networked organizational settings (Korpela et al. 2002; Braa et al. 2004). However, adapting the participatory approach in African contexts with diverse and internetworked organizational settings requires a multi-leveled and multi-sectoral approach. Community involvement and participation in ISD process is more important in African context than Scandinavian contexts since it alleviates problems like computer phobia and fears, and increases the user organization’s technological capacity to sustain the system and make a positive socio-economic impact.

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The Residual effect of Imbrication – How user’s past socio-technical entanglement affects IS adoption

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Abstract: The topic of digital age has been extensively covered in different settings. This paper explores the effect of users’ digital lives on IS adoption process. Using imbrication metaphor, first the study discusses the implication of user’s residual socio-technical entanglements for new IT implementation. The residual pattern developed using different digital media creates two seemingly opposite effect for IT implementation and design activities: Iron-cage effect and end-users broader participation. After presenting a case study of new IT system deployment, it further explores the effect of user’s past imbrication experience in adopting new technologies. Based on the empirical data, the study also demonstrates IT based technologies adopted for personal use can affect the process of socio-technical imbrication and future users’ intention IS adoption.

Keywords: Iron-cage effect, Imbrication, IS adoption, Cognitive artifacts, IS design

1. Introduction

The IS research field has conducted a wide study to identify factors that can affect end user’s technology acceptance [1, 2]. In addition, considerable attention has been given to information system development approaches and methods [3]. Despite such efforts, there are still evidences of unfaithful engagement (maneuvering technologies) of end-users during the adoption of new IT systems [4-7]. In addition to unforeseen changes following the implementation of IT system, end-user’s existing IT competency is cited as one of the reason for unsuccessful adoption of technology [8, 9]. In this regard, end-user’s daily interaction with computer based technologies, accounts for user’s proficiency and perception of new technologies adopted in the work place [10]. Consequently, end-user’s ‘digital lives’ increasingly affect the way users perceive affordances during the implementation of IT artifacts. This paper explores the effect of digital technologies that are adopted and practiced for personal use, but not sanctioned or directly related to procedures and organization IT systems. Based on a case study of newly implemented Learning management system, the paper present the implication of user’s computing background for adopting technologies. The paper then discuss how these phenomena affect the core IS activities of implementation and design.

In appropriating technology, users look for the material property that an IT artifact enables them to afford to achieve their goals. In the absence of such affordances, users tend to change their routines to efficiently continue their daily activities. Thus, during IT appropriation, it is inevitable that human and technology ensemble in a way that either technology changes to fit in to user’s routine or users change their routine accordingly with technological properties. [5]. The paper uses the notion of imbrication [5] to underline this socio-technical entanglement of human and technology. The model of imbrication enables us to explore the effect of background computing skills and how such a background affects the way users perceive a real IT affordance or create perceptual affordances in the absent of real ones.

There is an increasing evidence (including the presented case study) that many organizations are adopting in-house IS methods that enable them to modify deployed IT systems [11]. Such an alternative method of IS design heavily depend on user’s active participation. As we are living in digital world, user’s IT related skills are improved and diversified. The study explore if end-user’s digital lives affect how we design IT systems.

The paper draws on an empirical case study of the implementation of new Learning Management System (LMS) called Moodle that is deployed on three campuses of Mid Sweden University, Sweden. The system has been fully operational since January 2013 on all campuses, though it was partially adopted by different departments from early 2012. The Moodle technology is an open source course management system (moodle.org) that was built on the philosophical approach of “social constructionism” in Curtin University of technology in Australia by Martin Dougiamas [12]. The author were able to follow the implementation of LMS and have conducted an in depth interview with end-users and follow their appropriation practice for 6 months.
This paper proceeds as follows. First it starts discussing the theoretical framework by outlining users’ technology acceptance and long term use based on existing literature. Second, it provides how end-user’s ‘digital lives’ affect these two core IS activities based on imbrication metaphor. Finally, after presenting the case study, it further discuss the implication of digital age on IS implementation and design.

2. Theoretical Background

Digital technologies are increasingly permeates to our daily life in different forms. From simple equipment we use daily in our household such as TVs, refrigerators, DVDs and other digital stand-alone equipment to networked service available over the Internet, our lives can simply termed as ‘digital lives’ [13]. To avoid interoperability issues between digital equipment, efforts has been made to create digital profile patterns that concern with standardizing digital materials [14]. As a result, end-users are not only become savvy on how to use digitally developed equipment, but also are framed to expect standardized way of interacting with technology. In other words, we are taught to expect familiar affordances in technologies we adopt, even though technologies are developed for different purposes.

2.1. How user’s appropriate technology

With regard to technology adoption, there is a rich knowledge in the IS literature that proposes different ideas, methods, frameworks and theories as to why users’ accept new technology.

Turner et al., for example, [15] conducts a systematic literature review based on “six digital libraries’ to see if the idealized Technology Acceptance Model (TAM) holds water in different circumstances. They found that the ‘intention to use’ (BI) measure is directly correlated to the actual use of technology in working environment. The authors suggested that the other two measures included in the TAM, perceived ease of use (PEU) and perceived usefulness (PU) are “less likely to be correlated with the actual” use[15]. They warned against the ‘random’ use of TAM for different context and expect the model to provide the same result.

Waarts et al., [16] suggested that acceptance and successful diffusion factors change as the diffusion of the technology progresses. Citing a large-scale empirical study of ERP system acceptance among users, they demonstrate that strategic drives and attitudes toward new technology are important factors in the beginning stage of technology adoption. Later on, they found out that, the intention of accepting shifts to implementation issues “such as the scalability of the system and the yearly available budget”[16]. Their works indicate that it is difficult to find a ‘one size fits all’ indicative factors for technology appropriation method.

Another prominent work on this regard is that of Rogers’[17] diffusion of innovation theory. According to diffusion theory, a technology perceived as having a greater advantage, less complexity and more compatibility with existing system will be adopted more rapidly. Moreover, the diffusion theory provided a step-by-step decision process to accept new technology. It starts with gaining knowledge about new technology, to forming opinion, to deciding to reject or adopt the technology, then to implement the new technology and finally confirming the decision [18].

Others focus on technology-in-use processes to understand technology acceptance and successful adoption by users[6, 19]. Such studies show that technology-in-use brings change in work practice and users’ skill. Such changes can affect how users perceive the technology and affect their long term use of appropriated technologies. In addition, these studies show how users’ tend to change or alter technology, other than its intended use.

The above exemplars of literature show that there is a general consensus when it comes to the relationship between factors that affect the process of adopting technology and users’ experience and expectations. In addition, such experiences and expectations are continuously adjusted accordingly with external environment.

2.2. Conceptualize foundation

Appropriating new IT artifact (ITA) usually starts with the introduction of technology properties that can be afforded to achieve goals. Affordances are “properties of the world that are compatible with and relevant for people’s interactions” [20]. In the absence of affordances, users tend to change their routines. It is possible to have a wrong perception of affordance, hidden affordance or a clear constraint in new ITA [21]. In the absent or deemed
absent of affordances, users tend to create their own workaround (perceptual/cognitive artifacts) to fulfill their needs. Cognitive artifacts are human’s act of trial to create ‘real’ affordance where technology does not provide one or, even worse, constrain affordances. The entanglement between human and material agency creates a ‘residual pattern of interaction’ that can affect the adoption of new material agency. To explain the concept of residual pattern of adoption’, I will use Leonardi’s concept of ‘imbrication’[5].

Different theoretical perspectives were suggested in IS research to understand the interaction between human and technology, where Giddens’s work of structuration theory has been the most acknowledged. Jones and Karsten [22] have identified 331 IS articles ‘published between 1983-2004 that have drawn on Giddens’s work’ to examine the socio-materiality nature of human and technology. Despite its popular adaptation, structuration theory has also been criticized for giving a privileged position to human agency. Leonardi [5] reports that even though structuration theory “provides a useful framework for exploring” human actor’s role in the process of ‘structuring their environment’, it lacks understanding how artifacts play the same kind of role but in their own way. Rose et al. (2005) conclude that “structuration theory sees agency as a uniquely human property”, thus, toning down the actual effect that technology might have in determining the existing work systems. Other scholars including Orlikowski (2005), Markus (2005), Poole and DeSanctis (2004) have also shown their concern how structuration theory has been adopted widely in IS research, but failed to properly develop the determining role of technology in a given work process. The common critics among the scholars, is that “it lacks a specific capacity for theorizing the role of technological artifacts” [5]. That is, structuration theory fails to specifically distinguish and theorize the enactment power of material agency1 when it interacts with human agency. Some researches try to augment structuration and actor-network-theory to solve the deficiency of material theorizing power of structuration [23].

The imbrication metaphor has started to take root replacing the structuration theory to describe the interaction between human and material agencies without giving ‘unnecessary’ privilege position to either of the two [5, 24]. I used the word unnecessary to describe the caution we should heed as we use the imbrication metaphor since humans will always hold the authority and the will power to decide as to whether imbrication should occur or not in the first place. In brief, the concept of the imbrication metaphor is [24]:

The concept of … the reciprocal, self-reinforcing, often non-linear, impacts of one representation upon the other.

The imbrication metaphor gives equal power of shaping organizational routines to both material agency and human agency if a decision is made to imbricate between human and material agency. The metaphor helps to bridge the gap between ‘extreme poles of voluntarism and determinism’ while maintaining the free-will of human agency in deciding to appropriate a technology [5]. Both human and technological artifacts interweave (negotiate) together to produce an outcome.

The main contribution of imbrication metaphor for this study is its capacity to explain the ‘production of durable patterns’ that is produced from past interaction between human and material [5]. The imbrication process is a continual process that bases past experience between the two forms of representation as a dynamic unfolding process’[24]. Such durable ways of routines persist and affect new technology adoption. Thus, when facing new technologies, users not only look for technical properties, but also contextual patterns that they have created in their past interaction with other digital equipment. A constant exposure and interweaving with different IT based technologies can result in residual pattern of interacting with artifacts that share a resembling method of development.

The argument goes that not only the availability of affordances in technology but also the residual pattern of interaction affects the new technology appropriation process. This, by no means, implies the importance of availability of affordance in technology. In fact, the imbrication of human and material agency starts with and is realized through the mechanism of affordances. Introduced by perception psychologist J.J. Gibson [21], the concept of affordance has been used in different artifact designs to describe the interaction between designed artifacts and human actors [25]. The way we decide to design artifacts determines the kind of perception they create for the user.

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1 Material agency is defined as “the capacity for nonhuman entities to act on their own, apart from human intervention” (Leonardi, 2011)
For instance, “thin vertical door handles afford pulling while flat horizontal plates afford pushing” [20]. According to Gibson, we decide to pull a door handle instead of pushing because “the attribute relevant for grasping is available” [20]. The existence of affordance in artifacts is independent of perception, which means artifacts and their property exist whether they are perceived or not. It is possible to have a wrong perception in the interaction process, where inference of usage is needed for hidden affordance.

Gibson informs his concept of affordance with strong connotation of the effect that past knowledge has for present or future interaction. Faced with new technologies, users tend to look for what the tool affords them to do. Gibson wrote: “What we perceive when we look at objects are their affordance...what the object affords us is what we normally pay attention to”[21]. This implies that even though users encounter the same objects and properties, the affordances they perceive can be different. Affordances exist in the space between artifacts and end-users. Users can interpret them based on ‘their goals for action’[5]. User’s past interactions and affordances made with technologies to accomplish their goals are used as bases for interacting with the new technology at hand. In the absence of such affordances, users will tend to change their routine (e.g. workarounds) to continue accomplishing their goals.

An example how users base their past knowledge of affordance to create cognitive artifacts illustrates this point. Cognitive (perceptual) artifacts are “components users designed as work-arounds to system shortcomings or extensions to systems that add functionalities to meet evolving needs” [26]. They are intended capabilities. The cognition strategy used to introduce oneself with a new ITA’s affordance is also used in creating a ‘cognitive affordance’ in the face of constraint. Let us say a user is accustomed to tabular system for arranging numbers to write a report from the previous experience of using an IT system. When a new technology is introduced, the end user will continue to look for properties and objects that afford the tabular reporting system. In the absent of such feature, the cognitive artifact that a user will develop is expected to resemble the old tabular system, whether the workaround involves other technologies or not. That is, we tend to copy previously accustomed technology’s affordance as a reference when we construct a perceptual affordance. It is as if we were copying how technology enabled us to afford in achieving our goals. In the same manner, self-design organizations, for example, use “their own identity as a primary point of reference when they reconstruct” their next form [27]. Perceptual affordances are inevitable as self-design organizations go through different changes and users apply technology’s affordance notion as a reference when they construct a perceptual affordance.

Consequently, the way users come to understand a new system's enabling or constraining characteristics originates from their imbrications norms they developed in the past. In addition, when a new technology is deployed in organization, the new system is expected to interweave with “an entire history of imbrication that came before it” [5]. That is, accustomed way of appropriating technology affects the choices and patterns users follow to imbricate other technologies, the way they develop cognitive artifacts in the face of constraints and the way they identify affordances in new technologies. Humans continue to learn as they interact with technologies and that ‘lesson’ leaves a print for the next imbrication process.

The interaction with technologies teaches us how to identify and perceive affordances in similar technologies. Such residual effect can have two possible results. On the one hand, it can create what we will call the ‘iron cage’ effect. The iron cage effect implies that users continue to look for the same affordance and the same method of presentation of affordances. In this regard, familiarity of user-interface can play a critical role. As users get accustomed to old way of interacting with technology, they will expect the same affordances from new IT system properties and objects. If affordances cannot be perceived as they used to be in the old system, users tend to create perceptual workarounds that resemble features of previously adopted technology. On the other hand, as users become digitally savvy as a result of frequent use of different technologies, they might develop a skill that can help them to increase their participation in the IS design process. As outlined above, new systems are expected to imbricate with the existing context, which also include user’s way of identifying affordances in a given technology. If a user is exposed to other digital system that bases same IT technology, which may not be related to IT systems at work, the iron cage pattern can be durable and strong.
2.2.1. The effect of ‘Digital lives’ on IS implementation

As users increasingly imbricate with digital equipment in different parts of their daily routines, they tend to develop a specific type of entanglement pattern for each type of services. For example, the introduction of touch screen by iPhone creates a durable pattern of how we interact with touch screen based phones. Other phone industries follow the same suit by creating similar function based on the past imbrication history. Users have already created a socio-technical entanglement pattern and way of perceiving affordances. Such residual imbrication creates an ‘iron cage’ of thinking, where familiarly of IT system is expected by users in the work place.

In addition to the iron cage effect, past imbrication history informs how users develop cognitive artifacts and its durability in the work environment. Past residual entanglement with technology can come in handy when developing our own perceptual artifacts based on the affordances needed for daily work. The argument is that the cognition strategy used to introduce oneself with a new ITA’s affordance is also used in creating a ‘perceptual affordance’ in the face of constraint. We are using technology’s presentation of affordance method as a reference when we construct a perceptual affordance. New affordances are adapted to improve work systems, whether they are ‘real’ (originated from material artifact) or ‘perceptual’ affordance revealed as workarounds. If such perceptual affordances are shared and adopted by many, its durability as imbrication residual can increase overtime. Many organizations pick such perceptual affordances as a new user requirement to create real affordances using IT artifacts, thus affecting the IS design.

2.2.2. The effect of ‘Digital lives’ on IS design

One can assume that user’s frequent imbrication with different types of digital equipment can contribute to the emergence of digitally savvy end-users. That is, users can develop a critical eye on what and how affordances should exist as an end product based on their socio-technical entanglement history. Some end-users can go even further and participate in the IT development process, in which the End-User Computing (EUC) method can be cited as an example [28]. As a target audience for any IT systems, end-users’ participation in the development stage is expected. But as a result of frequent engagement with different systems, users can now participate not only as a source of user requirement documents, but also in the capacity of defining and perceiving affordances. Thus, frequent imbrication with digital equipment not only enables end-users to increase participation in IS design but also alters their locus from passive participation to active one.

In addition, as the digital world continues to construct new artifacts, users embrace new imbrications and socio-technical entanglements. These phenomena continue to put pressure on organizations to adapt user’s high expectations they have already experienced on personal levels. For example, an increased end-user’s imbrication with social networks may force organizations to integrate their IT system to such services. Such integration may in turn call for adopting IS methodologies that can accommodate system modifications. An example of such system can be a combination of in-house developed ISD methods with open-code IT system. The following table summarizes the analytical framework.

<table>
<thead>
<tr>
<th>IS activities</th>
<th>Digital living</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Iron-cage effect</strong></td>
<td><strong>End-users participation effect</strong></td>
</tr>
<tr>
<td>IS implementation</td>
<td>Residual dependency.</td>
</tr>
<tr>
<td></td>
<td>Durable pattern of perceiving affordances.</td>
</tr>
<tr>
<td></td>
<td>Constructing cognitive artifacts in reference of real IT artifacts.</td>
</tr>
<tr>
<td>IS design</td>
<td>Expectation of familiar affordance.</td>
</tr>
<tr>
<td></td>
<td>Too many entanglements to consider in the design phase</td>
</tr>
</tbody>
</table>
3. The case study

The objective is to study the effect of ‘digital living’ on the two cores IS activities: IS design and implementation. Thus, a follow-up case study of new IT system design and implementation is appropriate. The technology in question is Moodle, a learning management system implemented on three campuses of Mid Sweden University, Sweden. Moodle is an open-source system implemented on a phase by phase roll-out since the beginning of January 2012. The system has been fully adopted since January 2013, officially replacing the old learning management system, WebCT. Currently Moodle serves more than 17,000 students and the university’s 1500 staff under the supervision of Learning Management Center (LRC).

3.1. Research Method

We have applied a ‘content analysis’ [29] method to examine end-user’s technology appropriation behavior and identify their motives to resist or easily embrace new technology properties and objects. The university has nominated 16 so-called moodle champions who have been supporting the implementation process of Moodle. Moodle champions work under their perspective departments, and at least one champion is selected for each department of the university. I have conducted 30-60 minute long in-depth interview with 8 Moodle champions. In addition, 3 more LRC representatives (2 Moodle developers and 1 Moodle administrator) have participated in the interviews to share their experience. In total, 13 interviewees (4 female and 9 male) agreed to participate during the last 6 month.

3.1.1. Data Analysis

Analyzing the interviews, the study were particularly interested in locally implemented IS methods, resisted IS features, user’s computing background, existing cognitive artifacts, and overall intention of IT based system use. In particular, we have followed these steps:

1) All the interviews are transcribed and uploaded to Atlas.ti software

2) After re-reading all the interviews, about 20% of coding have been done manual. In doing so, I looked for patterns at conversation level. For example, repeated responses like “the new system interface is different and took me some time to find what I want” is coded as “conversant” to denote the residual effect of Old system.

3) After coding each response, the author looked for patterns (similarities) in each code. Three main themes (families as Atlas.ti calls it) have emerged (See table 3). Each family was then compared with the interviewees response based on the original code.

4) Based on these families, the paper develops logical relationship with the analytical framework.

<table>
<thead>
<tr>
<th>Categories</th>
<th>Descriptions</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conversant</td>
<td>User follow their familiar imbrication to adopt new technology</td>
<td>“I would like to have something similar to WebCT, since it felt home”</td>
</tr>
<tr>
<td>Cognitive artifacts</td>
<td>Perceptual artifacts created by users to fulfill IT system limitation</td>
<td>“I have workaround as well, which I created before long time ago, from WebCT limitation, but I continue using it, in fact I adapted my old solution (to) the new system”</td>
</tr>
<tr>
<td>Peripheral knowledge</td>
<td>End-user’s external knowledge that is applied in fulfilled their intended goals</td>
<td>“I know some teachers set up their own websites, either internal or external. They tell students to login to those software’s”</td>
</tr>
</tbody>
</table>

3.2. Presentation of findings

Based on the empirical data, this section discusses three main categories that emerged as main findings.
3.2.1. Conversant category

During the implementation of Moodle, user’s first reaction was to look for affordances that are similar to WebCT, which used to facilitate their daily activities (“I would like to have something similar to WebCT, since it felt home. As it is now if I want to use the same file in different course, then I have to uploaded twice or create a link which can create a mess in the end. I know there is a solution for these things in moodle, but it is not coming here yet.” Tagged08). Even though, features they were looking for existed in the new system, those affordances seemed invisible as they were not presented as it was perceived in the old system. (“I used to get question like ‘would it be good if I can do this’ then I would say, but yes you can do that” Tagged 04 (…) “The question is more about the equivalent options they can get in Moodle.” Tagged06).

Some features of the system were completely resisted or ignored. For instance, the users resisted the Moodle email system. (“it’s hard to find your emails, which mails I sent, when and to whom. WebCT was easier in this way. It was more like an ordinary mailbox. I don’t know if technology is limited or our knowledge about it” Tagged 07 (…) “The message system is the biggest weakness I would say. It is not natural the way it works” Tagged06). After examining the severity of this problem, LRC decided to implement a Gmail emailing system that reflected more familiar emailing environment. End-users started to use the Moodle email system and responded favorably. (“Yes. I use the new Gmail system rather than the old “message” available in Moodle. I think Gmail very similar to other e-mail systems that Gmail and outlook and that it is relatively easy to get started with”Tagged11).

3.2.2. Cognitive artifacts category

The case study reveals end-users persistent practice of perceptual artifacts and their effect on appropriating new technology. All interviewees complemented IT artifact limitations with workarounds created within or outside of the existing system. End-users continued to practice old system workarounds in the new system. (“I have workaround as well, which I created before long time ago, from WebCT limitation, but I continue using it, in fact I adapted my old solution (to) the new system. Workaround stick longtime may be even though you don’t need them anymore” Tagged08).

It is also observed that cognitive artifacts resembled other commonly used IT based system that end-users were familiar in their daily activities. (“Yes, of course, grading in excel file or importing to excel file. This is because I feel like more at home. I used to do that before in WebCT as well, so it is continued process. May be it is also feels good that you have the grades in your file inside your computer, so that you can manipulate the work as you want” Tagged01 (…). “In my department, the architects want to upload files but then I have to send those from outlook, so it is hard. We find some way around it, we instead start to use a forum to upload the files, but I don’t think that is efficient way to do it.”Tagged05).

3.2.3. Peripheral knowledge category

Apart from providing user requirement information, the study also shows that computer savvy end-users can provide valuable input for system improvements. This is especially true, when it comes to how affordances should be presented. (“Users on the other hand have no ability to improve system on their own, as the plug-ins is approved by LRC, but there are cases where users ask for different plug-ins directly. They went to other university and see how other do things and come and suggest those solutions.”Tagged01). Once users understand the existing system has a material resource to accommodate modification, it can promote them to provide ideas on how to improve IT systems. (“People will have to find out their own way on how to adapt themselves with the system after some time use and if that happens they will come up with some suggestion and plugins, especially if they know that the system can be adaptable. I think all users will find their way of being comfortable with a system.” Tagged01)

The study also observed that such users tended to use external IT based knowledge to improve real artifact affordances. (“I know some teachers set up their own websites, either internal or external. They tell students to login to those software’s. They see problems in Moodle and set it up on their own. I think LRC should approach such teachers and see the missing components. Uppsala for instance they actively approach teachers that they use their own system and this should be applied here also”Tagged02).
4. Analytical Discussion

This section discusses how user’s imbrication history results from daily interaction with digital equipment affects IS design (approach and method) and implementation (technology appropriation and on-going practice). In doing so, the study relates the empirical findings with the analytical framework outlined in Table 4.

4.1. IS Implementation

The case study shows that user’s imbrication history (Residual dependency) with older systems affects the implementation of new technology in the work place. Such dependency does not solely originate from workplace previous IT based system. As the Gmail account case shows (See Conversant category), personal use of IT systems can create imbrication patterns. That is, properties and objects of an IT system will only be visible as an affordance if it creates the feeling of easy imbrication already constructed with other systems. At times, such residual dependency can be durable if a user gets entangled with different system in a similar manner. Again in the Gmail example, many email systems are designed in a way that they create a standard kind of imbrication with end-users, even though the systems are provided by different companies. Many users are frequently exposed with email icons on the left side with different labels (inbox, sent, delete and as such). One can expect a durable pattern on how to identify the affordance of finding these labels and their function. A different pattern can result in resisting the new way, even though the functionality is available. Such cases illustrate the iron cage effect discussed in the theory section. Users are accustomed to specific way of perceiving affordances in technology. As we are living in a digital world, the likelihood of users to experience different IT system functions applied in the workplace beforehand is reasonably copious.

In addition, the evidence shows that cognitive artifacts implemented as a result of old system stay longer, even after new system’s implementation solves those limitations. In fact, one can assume that personally developed artifact’s residual persist longer than imbrications with systems developed by IS designers. The iron cage effect is also visible when users stick to what they know best. (“Never mess with something that works well. That is a round rule of course, so when it comes to moodle opportunities, should we use that?” Tagged04). The case study also reveals how users develop cognitive artifacts. Users were following their imbrication history as a reference to develop perceptual artifacts. Such imbrications may not occur only in the work place. Socio-technical entanglement residual can have a root from personal use digital equipment. Consequently, the iron-cage effect might develop from IT based systems that a user interact on a daily bases outside work practice.

Previous experience of digital imbrication enables to understand easily how new system works. In this regard, the case study shows that younger generation with more entanglement opportunities with digital equipment (e.g. digital natives [30]) easily learn how the new Moodle system works. (“Usually, older people are scared of computers and they don’t like they want to change I don’t have a lot of question from young ones. The young ones, they can do the same thing they used to do in WebCT, but they have to do it differently, it is not the same button or it is not the same page” Tagged06). As it will be discussed in the next section, frequent imbrication with different digital equipment may also promote users to increase their participation in IS designing process.

4.2. IS Design

Designing IT system for digitally savvy users presents both challenges and opportunities. As the case study shows, users exposure to digital technologies affects what they can expect from technology (See peripheral knowledge category). Consumer based digital equipment tends to change rapidly mainly due to competition in the business environment. Even though, accommodating all changes that users experience in their daily lives is not warranted, the need for acquiring adaptive technologies in the work place becomes justifiable. Consequently, implemented IT solutions can be abandoned if they do not satisfy future organizational needs. One can also assume that technological awareness increases not only the frequency of user’s participation but also the quality of input users bring to the table. Consequently, users are competitive enough to suggest technology affordances, how affordances can be designed, perceived, and materialized.

The IS design is also affected by the iron-cage phenomenon. The abundance of digital equipment results in numerous socio-technical entanglements. In addition, user’s expectations from familiar affordances can halt
innovations. Consequently, digital living has brought a different challenge to the IS design field, where organizations are expected to craft a balance between the iron-cage effect and a broader end-user participation.

5. Conclusion

This paper has explored the effect of ‘digital living’ on the success of IS adoption. In addition, the study briefly discusses the implication of digital living on IS design. In doing so, the research identifies two main accounts: the iron-cage and end-users participation effects. While imbricating with technology, end-users develop a durable and specific pattern of interacting with artifacts. Based on such patterns (residual imbrications), they tend to appropriate new technologies. If their experience of imbrication does not present itself in new technologies, they tend to resist adopting the new artifact. As a result, past imbrications create an iron-cage where practitioners expect the same way of perceiving affordances. Frequent exposure to digital media also results in technology savvy users. In this regard, end-users participation in the IS activities has increased, as they are well-aware of what to expect from IT system.

The study contributes to the IS field in different ways. Frist, it addresses the relationship between seemingly opposite roles of digital living effects. Even though, frequent exposure to digital equipment increases IT awareness, it also contributes to a ‘boxing’ effect where users expect familiar presentation of technology affordance. Second, based on empirical evidence, the study demonstrates the durability of cognitive artifacts and how user’s past experience to construct them. The end-users apply familiar digital equipment as a reference to construct perceptual artifacts. Finally, the paper highlights the effect of digital living on IS design process.

This study has several limitations. First, the empirical evidence limits the study to make conclusive evidence for the analytical framework. A case study of long-term use of technology appropriation and thorough analysis of user’s digital behavior may result in a conclusive perspective. Second, it is not guaranteed that digital living results only in two effects. Instead, I have presented them solely as an analytical framework. Finally, future studies are also warranted on the effect of locally adopted IS methods and approaches.

Reference

Relevant Social Groups Within the Open Data Initiative – a matter of intertwining meanings

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Abstract. This study sets out to explore the attributed meanings about open data displayed by the groups of people involved in the process towards the realization of the open data initiative sprung from the Public Sector Information directive. This is done by performing a case study of two municipalities in Sweden. Findings reveal a world of a large number of relevant social groups that interacts and intertwines in numerous ways and in various contexts, and where development evolves in different directions.

Keywords: public sector information, open government, open data, social construction of technology

1 Introduction

The realization of a society where an open government has made their data open for everyone to use for new purposes and thereby create innovation and new values triggers many challenges [14], [25]. Among these challenges is the diffusion of public sector open data to the groups of citizens that are thought of as the main users and thereby the creators of value [23], [26], [40]. Given the very nature of open governance, increased aim for citizen participation [14], increased transparency [1] and a transfer of value creation from government to citizens using the data [35], it can be concluded that the open data phenomena harbours a large degree of political and societal focus together with the enabling technology. Current literature and reports within open government currently contributes to the gap of knowledge about the involved groups of people in three different ways. First by grouping the involved people into very large and uncharacterizable groups like ‘citizens’, ‘companies’ and ‘government employees’ [24], [25], [35], [40]. Secondly, by focusing on the technological artifacts itself; the data, the portals that holds the data, or the ICT-enabled process for releasing the data [17], [31], [45], [52]. And third, this is done by emphasizing and promoting the desired benefits of open government based on open data on behalf of focus on the people who will realize the very same benefits [9], [10], [32], [37], [47], [50]. In parallel, a debate is taking place wherein it is claimed that the

1 Please note that the LNCS Editorial assumes that all authors have used the western naming convention, with given names preceding surnames. This determines the structure of the names in the running heads and the author index.
open data initiative “have tended to be developer-led” [36] and for those people who have the skills and resources to utilize ICT for transforming open data to services. This stance is supported within community informatics, saying that open data risk being a means that “further empower and enrich the already empowered and well provided for” [20]. Reports also reveal that governments have only tentatively started tracking the benefits of open data based on usage, but “has not yet positioned this within a wider, systematic evaluative framework” [4]. In Australia, efforts have also been made to understand the user group of researchers by involving them in their opening up process [39], thus aligning with previous identified importance to understand different groups of citizens need for information [2].

Apparently, there is a lack of in-depth knowledge about the characteristics of the relevant groups of people who are involved in the process towards realizing believed benefits [26] and insights into their needs and capabilities [1]. To acquire knowledge about the people involved in the process of developing an information system, regardless of role, is seen as an essential key to success. Without this knowledge, it is not possible to picture and understand the information system as a whole, since the construction of an information system in itself can be seen as a “social act” [5] dependent on human actions. This implies that a deeper understanding of the groups involved in the evolvement of the open data initiative will also increase our knowledge about how, where and by whom value is created.

This article therefore sets out to explore the groups of people involved in the process towards the realization of benefits based on public sector open data in order to further increase our knowledge about how and why different benefits with open data happens. In particular, the notion of what constitutes the core of a group of people, making them act and behave in a cohesive manner, will be explored. This is done by studying two municipalizes of different character, one big and one small, in Sweden in their current work of opening up their data. The study is draws on the current national debate which highly influences the work of the municipalities.

The first part of the paper introduces the readers to the theoretical field of open government which sets the stage for this article by providing insights about the contemporary evolvement towards the realisation of the open data initiative. Secondly, the methodological approach based on qualitative research and a socio-technical theoretic lens is presented alongside with an in-depth description of the two cases, their current situation and status in the opening up process. After this, findings are presented in a narrative form to further increase understanding of what groups of people are involved and affected by the opening up process, and in what context they appear. The article is then concluded with a combined analysis and discussion about what various groups of people that can be seen, all framed by a socio-technical perspective, to lead the way to the conclusion drawn from this research study about what relevant groups of people can be identified in the process for realizing the effects of the open data initiative.
2 Open Government

Today, when ICT has evolved and matured, the notion of “open government” has become increasingly popular. “Open government” is used as a buzzword representing the on-going extension of e-government as a trajectory that enables “new ends and new means” for facilitating an open culture leading to transparency, participation and collaboration, [30] and utilizing a high degree of web 2.0 technologies [17]. Open government is also told to represent the government’s ambitions to be transparent to and easily accessed by its citizens [8].

ICT also plays a major role in both the development of open government [30] and in the operation of it, building on Web 2.0 technologies and related culture [17], [41]. Practitioners says that the idea of open government and one of its key pillar “open data” has greatly influenced the way public sector interacts with citizens and the way innovation is created [30], which is supported by Janssen who refers to citizens as the resource that will leverage open governmental data into new digital services [24].

In the literature, a number of different definitions of open data exist. It has been noted [7] that the often referred definition, the “open definition” [44] is focused on the data artifacts itself. Davies also argues that it is important to address openness in processes as defined within the area of ICT4D, which includes the processes that make the data available, though on a larger level of “openness” in ICT [48]. A third definition says that the ‘open’ in open data is about changes in power relations between citizens and its government [35]. Implementing the European open government initiative, the Public sector information directive [6], [24], [25], has not been without complication, as noted by the National Audit Office in UK in their review of the British open data initiative. Initial focus has been on putting data out on internet and long-term strategies have been under-prioritized [4]. This strategy can also be seen in the Swedish governmental working document for guiding public sector organizations [11]. Open government initiatives makes data not only accessible but available in digital formats [45] and has not only reformed the governments relation with citizens [35], it is also believed to vitalise citizens interest in politics [18]. Citizens and companies are pictured as the target group for a new information market making citizens not only consumers of public information but future developers of new digital services and the public sector as its provider of raw material or as Don Tapscott describes the transformation: “government becomes a platform for the creation of public value and social innovation. It provides resources, sets rules, and mediates disputes, but it allows citizens, non-profits, and the private sector to do most of the heavy lifting” [30](p.xvii).

Bellamy and Taylor 1998 describes that early efforts of open government aimed at reforming the notion of citizenship and increasing democracy, but that in a practical sense, open government focuses of providing access to information. The information to which citizens where to gain access, were either considered a “commodity” that could be handled as “input” or “output” as in business transactions, or as fundamental ingredient of citizenship. However, the question of openness was controversial, which Bellamy & Taylor 1998 illustrates with a quote from Sir Humphrey Appleby that said: “Open government is a contradiction in terms: you are either open or you have government”, placing openness in opposition to governance itself. Contemporary with this was the development of guidelines for open information formats and publication
[43] promoting open information access, which Bellamy and Taylor 1998 argues were reinforced by opponents to openness as transparency, who instead directed the attention to “the commercial value of government information” [2]. Before the methodological approach is presented, a few clarifying words needs to be said about the open data initiative which in itself is a complex phenomenon and there might be doubts about what the actual developed artifact really is. The tricky thing about open data is that the information system under construction here is both national and at the same time local and that it may come out differently depending on which authority that does the work. In fact, it is not only one system that is about to be developed, but many separate systems with hopefully the same basic aim and function. It is national because all open data in Sweden will be gathered on a national portal which is under development, but the data will come from information systems developed by each public authority, guided by national policies [11]. At the same time it is local/regional or trade based and may differ in actual setup and design because all public authorities are somewhat different in character. They have different obligations towards the society and the citizens (either they serve the nation, regions in the nation or specific branches) and therefore holds different kinds of data. Even municipalities who have the same basic mission can be different to each other due to differences in size, regional interests and amount of resources. And at last, the open data from public sector is permeated by a democratic perspective which states that the open data should be there for every citizen, which makes a big difference, compared to private sector which gets to choose their target group. On the basis of this background, the information system for public sector open data will in this article be treated as the system developed by each public authority, with the aim of focusing on what they have in common, not on where they differ. The national information system will not be included other as something that the data is linked to.

3 Methodology

The research method used for this study takes on a qualitative approach based on a cross-case study of two municipalities within different contexts and also adopts a theoretic lens created on socio-technical theories for structuring and analysing the findings.

3.1 Social Construction Of Technology – The Basis For Relevant Social Groups

The Social Shaping of Technology field is a broad range of research that intertwines technological evolvement with societal issues aiming for a framework that makes us able to understand these different strands as a whole [34]. It is portrayed as a useful approach for contextualizing how humans interact with technology in our analysis of current events in our society, in particular for “processes and context that frame technological innovation” [22]. More recently, scholars within future studies claims that social shaping of technology “seems especially promising in areas of technology where visions are manifold, societal interests conflicting, and applications
and markets are non-existing or still under construction” [27], drawing on contemporary need to see technological and social change as a ‘bricolage’ which is both a driver for change and something that is driven by change. The political aspects of SST is emphasized and it is stated that IT artifacts are permeated by politics that makes the understanding of different technology based evolvements more difficult and not so straight forward as it might appear at a first glance [51]. Winner (1999) divides the politic characteristics of an IT artifact into two different categories; IT artifacts that become political because they are used to solve a particular issue within a particular community and IT artifacts that by their very nature and characteristics are political from the beginning since they require a certain political context. Within social shaping of technology, several strands of research can be found, and among them is the social construction of technology theory.

One of the most important aspects of the public sector open data phenomenon is the citizens of various character that are pictured as the users of the data, may they be companies or private persons or in some other form. Without them, the on-going effort with releasing data fills no real purpose. Since awareness and usage of data has not yet reached the desired levels and effective engagement seems somewhat problematic, the question of getting various citizens use the data is critical. The democratic, and thus political, perspective of public sector open data makes many groups of people equally relevant, and at the same time difficult to engage. Therefore this study will turn to the concepts of relevant social groups for guidance and analytic frames.

Within SST, the theory of Social Construction of Technology (SCOT) [46] can be found which was based on an interest to form new types of technology studies. The initial work was influenced by three trends; the “moving away from the individual inventor (or “genius”) as the central explanatory concept, from technological determinism, and from making distinctions among technical, social, economic and political aspects of technology development” [3]. SCOT is based on a number of key concepts. First, the SCOT approach opposes the traditional way of viewing the development process as a linear process, and choses to regard the process as multidirectional process instead. This means that the development process can be influenced from various directions and can also evolve in a multitude of directions which leads to a portfolio of different products [46]. Second, the way the development process is influenced is by the notion of different relevant social groups. These are the people involved and affected by a particular technological development who share the same meaning about a technological system or an IT artifact. Because people within a group perceive the IT artifact alike, they also share the view about which overall problems and solutions exist. The question about which groups are actually considered ‘relevant’ is described as all groups for which the IT artifact proposes some kind of meaning. This is exemplified by a group of non-users, for which the IT artifact in question affects their lives, drawing on the fact that less obvious groups of people in a wider context also should be included in the analysis of the development process. The relevant social groups are described not only by their perception of meaning, but also of their other characteristics such as degree of power, financial status and practical context. For the context of history and future, it is made clear that relevant social groups are not consistent over time, but are affected by changed perceptions and/or changed problems which make the group either grow or diminish,
much like a living organism [46]. Third, these relevant social groups harbor different understandings and meanings of the product/service which is called interpretative flexibility. This concept shows us that the characteristics of an artifact or system are subject to social variables. Both when it comes to differentiated interpretation and thereby the creation of different meanings, but also when it comes to the flexibility that governs how the artifacts are designed. Pinch and Bijker emphasizes that there is not only one possible way to design an artifact, even though many people hold the belief of an inevitable progress in the aftermath of a development process. The notion of interpretative flexibility therefore acts upon groups of people who merely interacts and interprets the IT artifact as well as groups of people involved with the creation of the very same IT artifact. Within this concept, the issue of whether the development process should actually lead to one or several IT artifacts to match different group’s interpretations can be discussed and argued. The interpretation itself, whether it is performed by users, non-user or designers, is governed both by the situated context in which the interpretation takes place as well as by the content of the artifact itself which draws on deeper social beliefs like the notion of what constitutes a fully working artifact [46]. Fourth, the concept of technological frames is closely connected to the concept of interpretative flexibility. This can be described as a relevant social groups “shared assumptions, knowledge and expectations or underlying belief system in relation to the technology” [38](p.92). It can also be described as the space that they are free to navigate their thinking and stretch their actions. Lastly, there is the concept of stabilization and closure, which becomes a tool for measuring the progress of development. The development of the artifact stabilizes as the relevant social groups problems are being solved, a process of gaining consensus, before a final closure of the development activities. Apart from closure based on solved the relevant problems closure can also be gained either by using rhetorical means, e.g. advisements to change user’s perceptions, or by redefining the problems into something that can be solved [46].

3.2. Case Study Design

This explorative research is based on cases studies on two municipalities in Sweden who have recently started the process of opening up their data. The first municipal is Stockholm City, the largest municipality in Sweden with more than 860 000 habitants covering the capital city of Sweden. This region is characterized by a continuous growth in both population and business life, which has led to a number of future challenges as in a growing need for public transports, enhanced city infrastructure and lack of housing for the growing number of inhabitants. Stockholm City started the discussions about opening up data in 2009, and in early 2012 they launched their open data initiative “Open Stockholm” with a hackathon focused on mobile applications and business ideas.

The other municipal is Skelleftea, a coastal municipally with approx. 71 000 habitants in Northern Sweden, also the second largest city in Västerbotten County in Sweden. This region can be characterized as an area with an active business life and positive spirit, but with the challenge of a constantly decreasing population that faces big demographic challenges ahead in the future. In early 2012 they started their first
discussions about opening up their data, and in late 2012 the practical work was initiated with a workshop and data inventory among all departments. This data inventory was conducted as cooperative effort between the strategic management and the researcher. Apart from the above mentioned differences, it must also be noted that since the two municipalities started the process at different times, which means different national contexts. Because of that, efforts have been made to stay as objective as possible to the course of the process of opening up. The differences between these two cases offer valuable insights into how the process of opening data looks like in different contexts and with different amounts of resources. But at the same time it will be more challenging to make generalizable conclusions from the findings because of these differences.

The rationality for choosing to study municipalities in this research is that all municipalities are governed based on the same basic foundation; to foster for their citizens living in the municipal area. Therefore, they are easier to compare with another and findings can also be disseminated more easily across the 290 municipalities in Sweden because of the similarities, than if other public sector authorities with very specific and distinct purposes, e.g. to support and legislate national taxation, had been investigated. Municipalities also serve every citizen directly because everyone lives somewhere, compared to national authorities like national health organizations or the national sea authority which only directly affects part of the citizens.

Data from the municipalities was collected through interviews, workshops and informal talks. In the Stockholm case this resulted in in-depths interviews with eight persons, of which six persons were employed working with strategic management and data ownership and two were external advisors representing regional business and the developer community. In addition to this, the events taking place within the conducted hackathon was closely followed both by participation and by web events and on-line forums. In Skellefteå, data was collected through four in-depths interviews with strategic management in addition to a workshop with forty employees that conducted a short survey and engaged in recorded focus group discussions. All interviews have been translated and results from informal talks and workshops have been documented. Concurrent to the case studies, the researcher has followed the national debate about the open data implementation throughout public seminars like [16] and in particular the development of national guidelines [11]. The first initial data analysis resulted in the interest For the analysis, the data material has been reviewed based on the research aim of this article.

The two cases selected for this study represent two quite different types of municipalities. The first, Stockholm City, is the largest municipality in Sweden with more than 860,000 habitants covering the capital city of Sweden. This region is characterized by a continuous growth in both population and business life, which has led to a number of future challenges as in a growing need for public transports, enhanced city infrastructure and lack of housing for the growing number of inhabitants. Stockholm City started the discussions about opening up data in 2009,
and in early 2012 they launched their open data initiative “Open Stockholm” with a hackathon focused on mobile applications and business ideas.

The second municipality, Skellefteå, is a coastal municipally with approx. 71 000 habitants in Northern Sweden, also the second largest city in Västerbotten County in Sweden. This region can be characterized as an area with an active business life and positive spirit, but with the challenge of a constantly decreasing population that faces big demographic challenges ahead in the future. In early 2012 they started their first discussions about opening up their data, and in late 2012 the practical work was initiated with a workshop and data inventory among all departments.

Apart from the above-mentioned differences related to the municipalities themselves, the two municipalities also initiated their open data projects at different times. Because of this, it has been possible to identify events, opportunities, challenges, etc. taking place in Stockholm and bring these observations and lessons into the Skellefteå case. The differences between these two cases offer valuable insights into how the process of opening data looks like in different contexts and with different amounts of resources. But at the same time it will be more challenging to make generalizable conclusions from the findings because of these differences.

Data collection and analysis

Data from the municipalities was collected through interviews, workshops and informal talks. In the Stockholm case this resulted in in-depth interviews with eight persons, of which six persons were employed working with strategic management and data ownership and two were external advisors representing regional business and the developer community. In addition to this, the events taking place within the conducted hackathon was closely followed both by participation and by web events and on-line forums. In Skelleftea, data was collected through four in-depths interviews with strategic management in addition to a workshop with forty employees that conducted a short survey and engaged in recorded focus group discussions. All interviews have been translated and results from informal talks and workshops have been documented. Concurrent to the case studies, the researcher has followed the national debate about the open data implementation throughout public seminars like [16] and in particular the development of national guidelines [11]. The data material was reviewed based on the research aim of this article. For this article, the case study will be presented in a narrative form to preserve the rich experiences and variations between the people participating in the study.

4 Relevant Social Groups within the Open Data Initiative

A relevant social group is a group of people that change the same overall meaning about the developed artifact and therefore acts within the same frame of reference. These groups can have subgroups representing a particular meaning. The empirical findings from the case study reveal that there are six overarching and central relevant social groups that in turn host a number of subgroups all related to a specific theme. These six central themes can be seen as perspectives that to some extent intertwine
and relate to each other, but yet can be distinctively identified and labelled; 1) creating new services, 2) business as usual, 3) co-creation of value, 4) enhancing knowledge and insights, 5) innovating the organisation, and 6) establishing a new service market for companies and developers. The case study findings mapping out these relevant social groups are described below.

4.1 Creating new services

The most striking thing about this group was that the heterogeneous combination of people and roles that was involved or articulated an interest in creating new services. As commonly described in current literature, software developers (in the data, most often referred to as younger guys with no or an quite small firm) and companies is probably the people that are most frequently pictured as the primary service creators. However, findings from public forums and interviews reveals that also journalists, information brokers (companies that packs data in new forms and sells it), established companies (e.g. IT-consultants) and employees at the municipalities are also progressing their thoughts about service development. However, they do this in different ways. In Stockholm, it was clear that both software developers and information brokers had a history of promoting the right to access data and participated in meetings and communication with the municipality in their quest for data. When services developers highly prioritized free data in open formats and, in particular API’s, the information brokers took the opposite direction and was satisfied with the format in which the data was originally published. It was also stated that information brokers “...are also willing to pay the costs...and they don’t make any demands for any particular portals ..” (Strategic management, Stockholm 2013), thus diminishing the idea of open data. The gap between software developers and information brokers were further increased by several stories about software developers scraping code from web pages because they just couldn’t wait for the data to be open.

Journalists were also quite early in using the data; in fact they arranged a hackathon based on open data from Stockholm during the same period as Stockholm City arranged a hackathon for software developers. However, the journalists were not perceived as service developers by the strategic management in Stockholm, despite the fact that the journalist hackathon included a theme called “best web service”. Rather, the skills acknowledged by the strategic management during a visit to the competition were instead transcribed to developers; “But developers should also be able to do this.” (Strategic IT management, Stockholm 2013). In a public open data forum, a journalist presenting their services based on open data described their growing interest in service development like this “it is very difficult to argue why you should do a job for three weeks for something that hits the news for two hours”. Compared to software developers, journalists was described as not primarily interested in API’s but much rather of raw data. The possibility to get in contact with knowledgeable data owners was also highly emphasized as important [29]. Overall, journalists are barely mentioned in discussions or associated to service development, neither in Stockholm nor in Skelleftea.
Open data was also pictures as something that would enhance existing services from municipals, using both their own data and others. And as described in the case description, both municipalities proved themselves to be open for procuring services as a mean to enable new service to their citizens.

4.2 Business as usual

Despite many promoters for open data and the new openness, there were some already established firms that advocated a more traditional business approach, much like the way they were used to do business. The regional business representative explained that many established companies valued a proper business agreement around the data because it was perceived as stable and trustworthy. An example is the earlier described information brokers who offered to pay for the data to gain a contract and had no need for a public display of the data. Also, the established companies perceive the situation as if there is a business relationship, when using municipal data, and that the municipal acts like there is no relationship. This causes confusion and frustration. E.g., during a public open data forum, a company wanted to know how they could show that they were using qualitative data in their new service, aiming for some sort of agreement to reveal to their customers to assure quality. Another ‘business as usual’ reaction but in a different context was found among the third party system suppliers who continued their quest for selling consultancy hours unmoved by the new openness.

The common business development concept of core business focus was strongly attributed to the municipals by both software developers and regional business representatives, arguing for municipals to adapt to traditional market rules and abide to this changing business landscape. This attitude was also to some extent seen in Stockholm, where the strategic management stated that they were planning to investigate “the possibilities to charge for the data... “ (referring to geo data that today is sold according to a financial model) that they regarded this “as one of the big areas that we feel we need to develop” (Stockholm 2013). Thus proceeding to do business the same way they did before data was supposed to be open.

4.3 Co-creation of value

The notion of co-creation was found in very different areas among different roles. Thus suggesting that value is often created together with other people, over traditional boundaries like organisational borders. Perhaps the most common sort of co-creation is the discussions between employees in public sector bodies and citizens and companies about what data should be released; a co-creation about insights on data needs. It is perceived as a giving and taking activity that brings more information about the users: “We should offer data for free, so it’s not for the money, but maybe to make the users tell us where they are from. That would be really nice!” (Data owner, Stockholm 2012), aiming for knowledge about how and where data was used. Co-creation of data and data quality is also found to be desirable: “Feedback on changes that could make our data easier to understand for our citizens...Presenting data in a
good and useful way is not easy” (Data owner, Skellefteå 2013). And this can also be seen in Stockholm in citizen-developed services that aim at e.g. reporting faults in the city or making faulty data visible and therefore also correctable by notifying the responsible municipal data owner. Data is not only seen as something that flows out from the municipals, but also something that can go in to the municipals via services or other sorts of communication. I was stated that a proposed way forward would be to start seeing the open data as a principle for the citizen’s right to openness, rather as a way of merely publishing data.

The use of data in services can also be attributed to a co-creation activity, often more related to the use of the municipal brand which is perceived as something that affects the perceived quality of the data and therefore also the service itself. However, this turns out to be quite problematic since there are no clear rules or experiences of ‘second line’ use of brand. The municipals are putting restrictions on the usage of their brand, and service developers and business promoters are arguing the opposite solution; to let them use the brand “Of course you should be able to tell where you got the data from, because you can’t pretend that this and this authority is responsible for the service.” (Regional business promoter, Stockholm 2012).

A software developer also explained how he sees himself as a co-creator of data streams, thus accredit himself access to the data “So I think that much of the open data, in particular the banks, they own an enormous amount of the transactions that we carry out. And I help the banks by contributing with my transactions to them. Therefore I can’t understand why I can’t get that data from them. And that goes for almost every other services that I use....If companies expect me to contribute with data, they need to give something in return.” (Developer, Stockholm 2012). And lastly, in Skellefteå, they regard themselves as co-creators of regional value together with local actors using the open data: We want to foster and support citizens and companies in developing Skellefteå together with us. We are a part of it, but we don’t own the question.” (Strategic IT management, 2012).

### 4.4 Enhancing knowledge and insights

In addition to traditional transparency that enable citizens to gain insight into public sector body information and organization by their own initiative, open data was also perceived as a means for pushing knowledge to the citizens. Strategic management in Skellefteå, journalists and other service developers aimed at enhancing citizen’s knowledge. As part of a public forum about open data in Sweden, a representative for a journalistic company presented four national web services based on open data, by describing their aim as “strongly mass educational” [29]. Other services created in Stockholm aims at giving people access to various transparency information e.g. planning documents and decision protocols. The reasons stated by the strategic management in Skellefteå is that they wants to make people interested in the municipality for mainly two reasons; 1), they have a need to recruit new employees but many younger people are not attracted to municipal work, and 2) they want people to stay in the region or to move in. For both reasons, they see that open data might be a possible way forward. A perceived hinder for obtaining transparency in Sweden today is current freedom of information act that is believed to be a hindrance to the
realisation of open data and the insights that can be gained thereof: “In Sweden we have a freedom of information legislation that we often commend ourselves for having had for a long time, since 1766. But to a large extent that’s paper based. We only have the right to receive information on paper today, and meanwhile public sector is becoming more and more digital this really becomes a problem. Because, we can say that we actually are gaining less and less insight since if you’re printing the data instead of delivering it electronically, you can never get the same amount of data.” (Developer, Stockholm 2012).

Enhanced insights and knowledge was not only pictured among the citizens but also within the walls of the municipal organization. Both data owners and strategic management expressed that open data would increase their own knowledge about what data they were actually harboring and that feedback from data users would make it easier to know what data should be released first. In Skellefteå, transparency was also related to insights into third party developers systems and code, which was thought as something that might hinder 3rd party data suppliers to give municipalities access to the data. Thus, open data is regarded as something that brings insights both to citizens and to the municipal employees.

4.5 Innovating the organisation

The empiric results reveal that open data touches upon many different aspects of the activities that are taking place today within the municipalities; increasing regional growth and prosperity, communicating with third party suppliers, engaging in a dialog with citizens, developing e-services and increasing internal efficiency. For all of these areas, open data provides means for innovation.

As previously described in the case study description, open data brings possibilities to handle regional growth both in Stockholm and in Skellefteå but in different ways. Stockholm uses it to deal with an increasing population and Skellefteå to deal with a decreasing population.

Open data was also described as a potentially good way to gain better control over negotiations with third party suppliers in Skellefteå; by moving the focus to the data in the systems rather than on the systems that holds the data. However, the strategic management also expressed that a big hinder for negotiating with third party supplier about getting access to data was a general lack of resources and an irritation on lack of support from national authorities. Since system suppliers to municipalities in Sweden are only a few per branch, it was strongly suggested that the national authorities would engage in discussions with the third party data suppliers about how they were planning to handle the issue of open data in general. This was also perceived as a system structure that needs to be changed, stating that “instead of all of us sitting here and inventing the wheel all over again, like we always do...this could be done very painlessly and cheap, instead of all of us having to hire consultants who does it and having suppliers who charges this 290 times” (Strategic management, 2013 Skellefteå).

Engaging in a dialogue with citizens was mostly expressed as discussions about what and how to release data, but dialogue was also told to be more about the right to transparency, about democracy and what could be regarded as core e-services for the
municipals. Also, companies expressed an interest to talk about how they could use the brand as quality assurance for their services.

The open data effect on municipals e-services was told to be of three different forms. First, the existing e-services could be improved with the knowledge about and access to open data. Second, new e-services could emerge based on previously closed data. And third, the discussion about what services the municipals actually should be developing and maintaining, and what should be left to external creators has been fuelled by the release of open data.

And at last, internal efficiency is thought to be catalyzed in numerous ways; 1) better insights to their own data might reveal data that they don’t use, 2) released data is being corrected by data users and service users, 3) new data on e.g. faults are being reported via open data based services, 4) “cleaning” data and making it more user-friendly makes not only citizens understand it better but also the employees, and 5) an increased focus on the data and open systems is said to fuel the ongoing work with improving general IT-architecture.

4.6 Establishing a new service market for companies and developers

National policy makers and politicians, and also regional politicians in Stockholm mainly promote the creation of a new service market by the hands of companies and developers, in favor of other effects of open data. In a speech, the minister of IT and Energy described that their job was to make sure “that open data is made available to all of the companies that could develop new solutions” [21], relating solutions to new services as a driving force for Swedish competitiveness. A local politician summed up the development in Stockholm with their newly released data as “new and exciting apps are being developed” [42], focusing solely on the creation on apps. This was a response to a debate article where e-government professor Kallberg et al claimed that Sweden are not doing enough in their open data initiative, also defining open data as having effects on the empowerment of civil society, increasing efficiency in public sector as well as creating new companies [28]. This focus on either companies and/or services can also be found in the initial strategy document on open data, stating that the proposed open data law “facilitates for companies that engages in re-use or intend to re-use documents from public sector bodies” [15] as well as in the digital agenda for Sweden [19]. The empiric data revealed that this focus on companies, developers and services was very strong also within strategic management in Stockholm.

8 Analysis and discussion

In retrospection, mapping the relevant social groups related to the realization of open data initiatives, displays a world which is much less straightforward and more complex than the traditional way of describing the involved people; policy makers, data publishers and citizens [40]. Rather, it reveals a world of a large number of relevant social groups that interacts and intertwines in numerous ways and in various contexts. Tasks that were previously associated with one group of people, e.g.
secretaries handing out information on request, have now moved into the IT-department and are done digitally. Also citizen focused service development is not only done by public sector bodies, but both by established firms, young developers and journalists. And most of the identified relevant social groups, however maintained on an overall level, were seen to incorporate people with different roles and from different parts of the society, thus forming the notion of an immensely dynamic arena for the open data initiative where clear descriptions of open data usage and meaning attribution might be difficult to come by.

The empirical data from this study do not tell us the full story about these groups; it merely puts the light of what major constellations of groups are present today in these cases. It does also however present us with some interesting findings for which the groups can be discussed. First, some of the groups do not seem to be heading in the same direction, on the contrary, groups can be seen to work against each other. Software developers, journalists and municipal employees in their role as ‘service developers’ value free data that can be elaborated on to create new services, a path that is counteracted by information brokers in their mission to create new services based on non-open data. Even though they too belonged to services developers that also belonged to the group that promoted business as usual; two perspectives that worked against each other when it came to the issue of whether the data should be free or restricted with a financial model.

The relevant social group of co-creation tells us a story about values that are being created together between roles and actors outside as well as inside the walls public sector. It also tells us that this value appears in different places, drawing on a rather dynamic landscape. Co-creation can be described to appear at different levels; around the data, in the creation of services and in the process towards reaching regional value. This proposes a different view compared to current descriptions of open data effects, where creation of value are more pictured as being the result of stand-alone roles, e.g. employees, software developers or researchers. The relevant social group ‘Co-creation of value’ shares many aspects of value together with the relevant social group who attributes ‘Enhancing knowledge and insights’, in particular the notion of creation value in the society, but here in the form of knowledge and increased insights. As clearly stated with the relevant social group ‘Establishing a new service market’, to create knowledge and insight renders much less interest from the policy level than the creation of digital services that are commercially viable. That is, services that is created by software developers and companies, not by journalists. In this case, one must wonder if, in conformity with the notion of technological determinism [34], the open data initiative in Sweden harbours some form of economic determinism that fails to see the long-term benefits of diverse services. However, given the amount of recent reports and other communications treating the open data initiative literally as a goldmine with the potential of huge sums of future revenues [9], [37], [50], this might not be such a surprise.

The relevant social group of ‘Innovating the organisation’ also reveals some interesting results, in particular big difference between Stockholm and Skellefteå in how they perceived the relation with third party data suppliers as a motor for innovation; mainly Skellefteå pictured this as a big driver for implementing open data as well as a way to innovate the organisation. One can only speculate whether this had anything to do with Skellefteå being a very small municipal with both less resources
and an organisation that made the strategic IT management to be more practically involved with third party data suppliers.

In sum, this aligns well with the social shaping of technology theories of a multidirectional process instead of a linear development process [46]. The identified relevant social groups aim for different things and also propose different values as well as solutions to problems. By utilizing the notion of a multidirectional process, we can more easily understand both what makes certain strands successful and how these groups differ in power and strength [46].

Another SCOT factor is technological frames which are described as the shared assumptions, knowledge and culture in relation to the developed artifact that determines the extent and variations of people’s decisions and actions [38]. Using this theory as a discussion model, one can speculate whether the intent to investigate the possibilities of charging for the data, proposed by strategic IT management in Stockholm, in fact was a result of the current technological frames found at the department hosting the data portal, a department which today is governed by a business model for financing data. It makes sense that a culture that for years has sold data to both private persons and companies would act, unwittingly or not, within their accustomed frame of reference. Particular when opposed by other actors, the information brokers, that reinforces that picture of how the open data process might evolve; that is, that charging for data is not a problem. Meanwhile the European debate is heading in opposite direction, to reduce costs for data [13].

Technological frames also seem to be linked to which groups are perceived as being relevant. Empirical data reveals that software developers are much more associated with creating societal values via services than journalists or established companies and therefore they are invited to the process to a larger extent than others. This is not something revolutionary, open data hackathons has almost become an indisputable part of the opening up process. Software developers were told to be more innovative and knowledgeable about service creation than journalists. What is interesting to discuss is whether this focus and extended acknowledgement of the software developers, instead of the entire group that attributes service development, is somewhat connected to similarities in technological frame of reference. Developers are often thought, as well as municipals, to create services that are practical and useful for citizens and which makes the citizens daily life easier in a practical sense. An example of this can be various traffic apps created by developers and municipal e-services for reporting sick kids. Both of these can be considered both typical and practical. Journalists on the other hand create services with a more educational and informative character, e.g. national environmental data services or services displaying insights into national school data [49], drawing on transparency rather than practical daily use; services that are more differentiated to most municipals e-services, and sometimes also exposes municipal for external scrutiny. Because of the democratic perspective of open data, technological frames can therefore be connected to the question, about which roles are considered to be relevant in the first place, and thereby also acknowledged and invited to participate in the development process. By making this connection, the notion of the degree of power each relevant social group acquires becomes all the more visible, and can be described as the difference between being affected by the open data initiative and being involved. The question about which group of people should be considered relevant also focuses of the definition of
relevant. Relevant social groups are defined as the groups of people that have formed some kind of meaning of the artifact in question, based on examples from the development of commercial artifacts [46]. However, empirical findings reveal that this limitation is not enough for the governmental context, and that the word ‘relevant’ needs to gain an extended definition; to also include those who not yet have had the possibility to form a meaning about the developed artifact. These people, seen as citizens in general, is seen as relevant because of the fundamental notion of democracy that lies as a non-optional fundament in democratic governance. Citizens in general are not only seen as current and potential users of data, but also as users of a service provided by the municipality, even though they are not yet familiar with this open data service.

In many ways, the changing scene of data usage visible in the described relevant social groups share many similarities with the focus areas within constructivist studies dedicated to the alignment perspective [33]. The alignment perspective proposed by Leonardi and Barley is said to incorporate a macro-social concern focusing on understanding how technologies can “alter or reinforce existing social systems” [33, p.24] and thereby change roles and relations rather than understanding the micro-dynamics of particular use and users ability to shape their own practice.

This finding has implications for both future work with realisation of open data initiative and with research related to open government and social construction of technology.

Not only have the relevant groups in themselves differed, also the municipals on an overall level display very different contexts and perceived problems and solutions. Stockholm City for instance, is exposed to a much larger number of supporters and promoters for different causes and is also in the close proximity of national governance related to the PSI directive. The latter can be seen through the national networks surrounding both employees in Stockholm City as well as the advisors for the realisation of open data. The fact that Stockholm is the capitol city of Sweden is also likely to add to the extended exposure. The context of Skelleftea is rather the opposite; no external advisors or promoters and the connection with national governance are more via national strategy and guidance documents rather than via personal networks. They instead rely on cooperation with regional neighbours. Stockholm do cooperate with other municipals, but they are not dependent on it. To what extent this affects the outcome of the actual realisation of open data cannot be entirely determined by this research. But it is clear that being a large municipal attracts more competence and support in different forms than being a small municipal, at least early in the process. It is likely that these insights create implications for future policy work, in particular the work of creating guidelines that supports different kinds of municipals.

9 Conclusions

This study set out to explore what relevant social groups were present within the open data initiative by studying two municipals in Sweden during their first steps towards realising open data and the PSI-directive. Social construction of technology
theories was used as a theoretical lens. Findings reveal that a large group of relevant social groups could be seen, and that they interacted and intertwined in several ways that strongly supports the theory of a multidirectional development process. The different relevant social groups were also seen to take different roles at different phases of the development process, acting in a dynamic rather than stationary manner. These different roles could be characterized into four basic roles; promoters, provider, users and beneficiaries. Technological frames, being a factor that describes the shared assumptions, knowledge and culture that guides and determines the actions of a group, was also seen to be of high explanation relevance. For these cases, it was seen that technological frames was connected to the question of which groups are being considered relevant or not, and also to the question of power diffusion among the relevant social groups; a matter of being involved or affected by the open data initiative. Empirical findings also reveal that notion of ‘relevant’ needs to gain an extended definition; to also include those who not yet have had the possibility to form a meaning about the developed artifact. These people, seen as citizens in general, is seen as relevant because of the fundamental notion of democracy that lies as a non-optional fundament in democratic governance.

In relation to the findings on the relevant social groups and their interactions with each other, the empiric data also brought forward a picture of four different scenarios were data flows into the municipalities. This finding challenges the prevailing picture of the open data initiative being merely about publishing data to the citizens and companies. In summary, this study shows that the realization of the open data should benefit from an increased awareness and knowledge about the characteristics of different relevant groups since that would lessen the perceived uncertainties about what and how to go about. Broadening the view of which groups in society and within public sector that are relevant for the open data initiative, and for what reasons, would improve our understanding on how the perceived benefits with the open data initiative could be obtained.

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Educational technology in teaching: What do teachers perceive they need in order to develop their professional competence?

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Abstract. This paper addresses the challenge of how to reach an Information and Communication Technology (ICT) competent teaching faculty in the Swedish compulsory school. Continuing professional development (CPD) can be a means to reach ICT-competence among teachers. In order to achieve successful CPD it is important to understand what teachers’ perceive they need in their professional development, which is examined in this paper. The study was performed in order to get a better understanding of the challenges associated with achieving ICT-competence. 17 teachers have been interviewed to investigate how they perceive needs regarding professional development and how they want these needs to be met. The interviews were recorded, transcribed, and analyzed by learning theories suitable for professional practices. Teachers’ expressed needs were interpreted as well aligned with CPD methods advocated in research literature, but less aligned with previous CPD initiatives. Their expressed needs were highly divergent, depending on individual competence, motivation and learning preferences. Previous ICT initiatives may therefore have been too uniform to be effective.

Keywords: teacher learning, teacher professional development, Swedish schools, defense, resistance, proximal zone of motivation, cognitive disequilibrium.

1. Introduction
Despite its relative short history, the development towards digitization in the Western society has been explosive and extensive. This development has substantial consequences for individuals as well as society in general. Technology provides a range of opportunities as they are becoming more important and integrated in peoples everyday life [1]. The European Union currently supports a giant investigation of information and communication (ICT) usage in European schools, the “Innovative Technology for an Engaging Classroom” [2] and the Swedish National School Board performs a corresponding study [3]. During 2006, the European Parliament listed a
number of key competences which were considered necessary to achieve personal development and active citizenship as well as social inclusion and employment.

Societies, organizations and personal lives have been deeply affected by ICT. Since ICT is becoming an increasingly important player, new opportunities are created for communication, relationships and work. In this context, the school as a social institution has a central role in preparing pupils for this digital living. ICT has in many ways found its way into Swedish compulsory school. Already the former national school curricula of 1994 state that implementing ICT in Swedish schools is a democratic issue: a right for all students irrespective of gender, class, ethnicity and geographical location to become familiar with ICT in school. In the latest curriculum, digital competence has been even more highlighted and emphasized, and digital competence has been acknowledged as one of the major competency areas for schools to develop for all students alongside with reading, writing, counting and democratic competence [4]. Other reasons for introducing ICT in the Swedish schools relates to preparation for working life, improving learning, change involving school development and the internationalization of education [5]. Hence, in today’s society ICT is considered both necessary and a means to improve learning. The ambition from politicians as well as school boards is apparent: a generally implemented ICT-competent school environment for all students.

However, recent reports claim that ICT investments in Swedish schools at that time were low, unequal and that only one percentage of the teachers at K-6 level use ICT daily to support teaching [6]. Today, the investments in schools concern availability and increase in computer density as well as implementation of various types of artifacts such as interactive whiteboards, surf tablets and learning platforms. Access to technology is a prerequisite, but does not necessarily imply usage; the individual teacher’s attitude, digital competence and preferences highly determine the frequency of technology-aided teaching [7] [8]. Neither do ICT equipment in the classrooms per se create new teaching practices. Many teachers, as well as many pedagogical ICT-applications, use the new medium in a substitutive manner by “reinforcing old ways of teaching and learning” [9] [10].

The quality of teaching, i.e. the teacher’s ability to provide effective teaching, is the most important factor affecting students’ learning [11][12] [13] [14]. There are numerous success stories of ICT-based innovative teaching experiments reported in research literature, for example significant learning gains in writing skills [15], mathematical understanding [16], and digital competence [17].

The advocated method to approach ICT-competence development among the teaching staff is to provide continuing professional development (CPD) where ICT-usage is integrated as a natural ingredient in the didactic process [18][12] [14]. Research has shown that continuous support, social networks, consulting and CPD activities that are well integrated in daily work are important for school development initiatives to succeed [19].

However, these novel teaching experiments are often run by researchers or by early technology-adopters among teachers. For a general uptake of technologies and methods in teaching and learning, the focus needs to be on the mainstream majority of teachers and the support they require [20], and for this group we have not yet seen the desired change take place. Hence, the democratic vision of a general ICT implementation in all schools, by all teachers, in all subjects, is not yet reached.
To address this problem, the overall research question is as follows: How can a sustainable subject-based ICT-competence (e.g. ICT-competence adjusted after the subject) be reached for all teachers in order to achieve generally ICT-competent schools in Sweden? As a first step towards this broader question, we have started to investigate teachers’ own perception of what they need to develop further in their teaching practice and how these needs can be met.

2. Related Research

It is claimed that the benefits of ICT-based teaching lies in transforming learning to new forms and redefining the nature of teaching. Here, we will use the term subject-based ICT-competence to refer to such ability to adjust ones teaching to the subject as well as the technological development in order to best support the students’ learning of skills and abilities crucial to the subject [13]. Note, that such competence does not mean to simply add ICT to the same manner one has always been teaching, it means understanding the potential of new technology and from there explore how crucial skills and competences of the particular subject might be acquired more effectively by these means:

“Developing digital literacy in subjects of the curriculum is not about being fashionable or simply about trying to engage students in learning. It is about addressing the changing nature of subject knowledge and acknowledging that students will need different kinds of skills, knowledge and understanding in order to develop their expertise in subjects” [13]

For instance, the expectations from society on language use has changed: students ought not only to read and write, they are also expected to evaluate, compare, analyze and comment on texts, or handle sound and image-enhanced texts [21]. In digital writing, skills of cumulative writing, reflection and revision are emphasized [22], and the process becomes more iterative, visible and authentic due to the unlimited online audience [23] [24][25]. To avoid shallow constructivism, i.e., the lack of understanding of what is learned and why [26], instruction requires thoughtful planning to gain positive results [25] [27].

However, it requires a lot: motivation, time, imagination, effort and sometimes courage to relearn and alter ones professional behavior, so it is not surprising that the enthusiasm and competence of using ICT for novel teaching vary greatly among teachers. There are also concerns whether such novel teaching methods are congruent with the required knowledge in standardized tests [28]; [29], which are the benchmark schools performances are measured by. In our approach we acknowledge that the teacher profession is constantly imposed by reformation concerning new curricula, new technology and changing expectations from politicians, school managers, parents and their students to “teach for the future”, so the profession’s willingness and ability to adopt is often at stake.
3. Theoretical Concepts

The advocated method to approach ICT-competence development among the teaching staff is to provide CPD where ICT-usage is integrated as a natural ingredient in the didactic process [12] [14] [18]. In research literature it is emphasized that collegial collaboration, continuity, classroom observations, involvement of outside expertise as well as reflection and experimentation are success factors in competence development [11] [30] [31] [20]. However, teachers’ current views, attitudes and values concerning teaching must be challenged in order to develop new ideas and ideals [32], [12], since transformative learning will not occur unless such critical questions are posed [33].

Research has shown that continuous support, social networks, consulting and CPD activities that are well integrated in daily work are important for school development initiatives to succeed [19]. Management commitment plays a role to pursue a sustainable change, by explaining and creating the posed challenges meaningful to the teachers. Initially, this means to make teachers aware of their learning needs and thereby motivated to engage in a change process. Thereafter, the management’s challenge is to support teachers to maintain their engagement by providing opportunity to affect their situation so that the required changes will not be perceived as overwhelming and discouraging, but rather as feasible and stimulating [19] [34].

Short, time-limited initiatives such as single development days or occasional courses do not normally result in sustainable, valuable effects [19]. Professional learning communities, on the contrary, have the power to pursue improvements and changes that lasts. Professional learning communities is based on the ideas that school development should start from the teachers’ experiences by reflecting on their practices together with colleagues who share these experiences. By active engagement in Professional learning communities, teachers are expected to develop their professional practice and improve students’ learning [35].

Illeris [36] however criticizes researchers and others active in the educational field for too narrowly focusing on what happens when learning occurs. Illeris states that it is just as important to examine what happens when the intended learning does not occur. To understand why learning is not taking place, one can thus turn attention to the barriers that may exist. The concepts of resistance and defense are suggested as models of explanation. Defense concerns the driving force, or rather lack of driving force for learning. Defense prevents learning through unconscious psychological mechanisms. The defense mechanism intends to protect the individual from learning that can disturb the mental balance, why learning can be a difficult process. Illeris [36] reasoning is similar to Piaget’s ideas on Cognitive disequilibrium [37]. Piaget describes a state of cognitive imbalance when encountering information that requires us to develop new or modify existing knowledge. Disequilibrium is often an uncomfortable state for individuals, thus we seek to quickly return to a state of equilibrium, either by ignoring the new or modifying our previous knowledge. Engaging in such modification requires mental energy, and may be experienced as anything from a stimulating curiosity to a transformative burden. Defense is thus about rejecting learning and is possibly the most important psychological factor explaining why learning fails or why it differs from what was intended. Furthermore, Illeris [36] states that both security and strong motivation is required to overcome
defense, since defense significantly contributes to maintaining self-esteem and identity.

It can be difficult to distinguish defense from resistance, and, in some situations they act simultaneously. But while defense is something that has been built up over a longer period of time, resistance becomes mobilized in contexts where the individual faces situations that he or she can not or will not accept. It may involve a general context or be linked to specific situations. Resistance is generally more conscious while defense occurs automatically.

Illeiri [36] consider adults learning to be partly different from children’s, since adult’s identity has been formed over time and simultaneously developed a defense against learning that can threaten identity. Also, adults tend to learn what they want to learn and that they find meaningful, and are reluctant to learn what they can’t see the use for. Often there is ambivalence between wanting and not wanting to engage in a learning process – something that seems to be increasingly more common with the increasing social demands on learning and development. Requirements or expectations that are perceived as overwhelming tend to block learning.

Inspired by a well-known idea of Vygotskij, the proximal zone of development, there is a corresponding model regarding the value aspect of motivation [38]. The model suggests that there is a proximal motivational zone in which a learner is able to value or appreciate new knowledge, i.e. a zone in which the learner is ready to be motivated but needs assistance to learn to value the new activity or domain. Ideally, a learner identifies with an activity or domain, just as she identifies with a style of music or a hobby. Identification can explain why some individuals value certain learning domains while others do not.

There are some major challenges in this research area concerning 1) how competence development should be organized to ensure sustained competence levels when the profession already experiences heavy time constraints [39] and are challenged by quick technological changes [13], and 2) how to organize competence development to motivate the entire teaching staff to change their teaching practices enough to involve ICT effectively for the benefits of all students’ learning.

4. Research Approach

In order to get a better understanding of what teachers perceive they need in order to develop their professional competence, an interpretative approach was chosen. Interpretative studies aim to understand phenomena through the meanings people assign them [40]. Interpretive research has emerged as a valid and important approach to information systems research. Furthermore interpretative studies can be a significant asset within the IS research in terms of understanding the context within which information systems operate [40]. In particular, when the aim is to find out and better understand how specific individuals experience use of IS, qualitative interviews is considered as a suitable method for data collection [41].

4.1 Project Background
The study of this paper is a starting point of a PhD project with the overall aim to examine how to reach an ICT-competent teaching faculty in the Swedish compulsory
school. The intended approach is to develop, study and evaluate the impact of different methods of CPD over a longer period of time. In order to pursue CPD relevant to the teaching faculty we started our investigation in order to gain better understanding of teachers' working situation and their views of professional development.

The importance of studying teachers' working situation and their view of the professional development was sprung out of (and is now a part of) a current national program on developing mathematics in schools. The Swedish National School Board finances this project, which runs over a two-year period. The project is conducted as collaboration between researchers and practitioners, and involves about 60 teachers and 1000 pupils from a municipality in West Sweden. The project was designed with regard to earlier research on how CPD should be designed to be successful: using action-based research by the means of learning studies which is considered to be critical dimensions of the professional development of teachers e.g. [42] [43] including collegial collaboration, continuity, classroom, observations as well as reflection and experimentation in the actual teaching action. Hence, the project implemented all the described above ingredients known to be successful in competence development. Yet, we experienced that even our dedicated, highly skilful and interested teachers had problems to engage to the extent they wanted in the CPD activities. It became increasingly clear how complex and versatile teachers' working situation was and also how challenging it could be for teachers to fully engage in provided CPD activities. Asking us why, we decided to further investigate what teachers themselves perceive they need in their professional development.

Thus the focus of this paper is to further investigate what teachers perceive they need in order to develop in their competence. This in order to gain knowledge of how CPD should be designed to appeal to teachers, both in content and form, and explore the possibilities as well as the obstacles.

4.2 Method

The chosen method of investigation was individual interviews, since we were interested in each respondent’s perception of their own situation, and their personal view of their professional practice. The interviews were organized in 4 themes, each theme with an explicit purpose and a set of open-ended questions for the interviewer to choose from, all with the intention to get the respondents in a narrative mind frame to describe and give examples based on their own experiences. The narration-based inquiry approach was intended to not only describe factual situations but also uncover the respondent’s judgments and personal values of the topics of interest.

The respondents were recruited from participants in the on-going CPD project, due to easy access and since the participants could thereby register the interview time within the project. The recruitment base was both current participants and those who, for different reasons, no longer were participating. The inquiry was not intended as an evaluation of the on-going CPD project, on the contrary we did not want the teachers to be constrained by their relation to us as collaborating partners, so we tried to be very explicit about our intentions. Also, the interviewer was new and less connected to the project.

The study included 17 interviews with teachers working in the Swedish compulsory school, all from the same municipality but from several different schools and areas of
socio-economic environments. Thus the interviews were based on an open conversation in dialogue with the respondents. This is in line with. In the interview situation the interviewer first introduced the purpose of the study and the following conversation was concentrated around the following predetermined themes:

1. Background questions designed to explore respondents’ views of their professional role. Why did the respondents become teachers? What do they perceive as key aspects of their professional role and what is their pedagogical approach. What makes them grow as teachers? Purposely we asked this last question prior to getting into discussions of competence development, since we did not want respondents to be constrained by their idea of more formal and organized forms of professional development.

2. The respondents work situation. What does everyday working life consist of and how is the workload? Who has expectations on their professional performance? What assignments are included in their profession?

3. Continuing professional development: what are the respondents' visions and experiences? How should CPD be designed to appeal to them? Do they want CPD and do they have the option to choose?

The overall aim of the questions was to obtain and understand teachers perceived needs in order to develop their professional competences, this by getting an in-depth understanding of the respondents’ situations: What are their incentives? Do they feel the need and the urge to learn more, to develop their professional practice? If so, what do they need in terms of external support, activities and circumstances?

The interviews were conducted at the respondent’s respective workplace and lasted between 40 to 90 minutes. They were recorded and afterwards transcribed. Two researchers extracted excerpts that were judged to be of interest to our research question from the transcripts independently, and compared the results. These excerpts were analyzed according to the interview themes, but also arranged and rearranged into evolving categories while interpreting the data. Issues of interest as well as the categorization of topics evolved during the analysis. Analyzing our data, two main categories occurred which were considered particularly relevant to our research question: 1. What teachers felt made them progress in their professional practice and 2. Their experiences related to CPD-activities.

5. Results

From the transcribed interviews, 213 text segments were perceived to relate to the questions of interest, and extracted. The excerpts were categorized as a result of our coding process and divided into two main topics, that corresponded to questions about 1) practice progression and personal growth and 2) experiences related to CPD activities. The respondents were divided in three groups reflecting the length of their teaching experience: short (1-5 years), medium (6-14 years) and long (15 and more years). There were 4, 5, and 8 respondents in the respective groups.
To get an overview of the distribution of respondent’s responses, the evolved categories and the number of excerpts within each category is shown for both main topics in the table below:

Table 1.

<table>
<thead>
<tr>
<th>1) What makes you progress in your professional practice/grow as teacher?</th>
<th>2) Experiences related to CPD activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content</td>
<td>Conceptual</td>
</tr>
<tr>
<td>specific knowledge</td>
<td>6</td>
</tr>
<tr>
<td>didactic approaches</td>
<td>5</td>
</tr>
<tr>
<td>Form</td>
<td>subjective definition</td>
</tr>
<tr>
<td>own reflective practice</td>
<td>10</td>
</tr>
<tr>
<td>collaborative practice</td>
<td>10</td>
</tr>
<tr>
<td>justification of practice</td>
<td>11</td>
</tr>
<tr>
<td>formal education</td>
<td>1</td>
</tr>
<tr>
<td>Organizational issues</td>
<td>about organization</td>
</tr>
<tr>
<td>more time</td>
<td>13</td>
</tr>
<tr>
<td>shared responsibility</td>
<td>5</td>
</tr>
<tr>
<td>resource utilization</td>
<td>9</td>
</tr>
<tr>
<td>All</td>
<td>about form</td>
</tr>
<tr>
<td>Total</td>
<td>213</td>
</tr>
</tbody>
</table>

5.1 Progress in professional practice
The first topic was divided into three categories: content, form and organizational issues.

5.1.2 Content
Regarding content, the specific knowledge the respondents discussed concerned ICT (3), research results, mathematic methods and swim practice. Two respondents expressed a reluctant attitude towards ICT, as illustrated by: “Personally I don’t think it is very important... my 2nd graders don’t need to know the computers”. In the didactic approaches the respondents revealed teaching dedication; the excerpts concerned the perceived deficiency to make all children reaching all goals in the curriculum, as illustrated by: “to find, to find methods ... for pupils with special needs”.

5.1.3 Form
Most excerpts concerned the format in which teachers develop their practice: by own reflective practice, collaborative practice, justifications by others or by organized courses. Own reflective practice mainly illustrated their reflection-in-action: how they deliberately tried out new approaches, new ideas, new ways of handling difficult situations, and intended reading about research: as illustrated by: “Sometimes I feel, oops this was not good at all… then one must reflect on what went wrong” and “All the time I get new perspective of things, and I try, yes I try new things… All the time.”

The value of collaborative practices are in all excerpts in this category, such as: “I think one learns much more by collaboration, I don’t think I learn as well when I only have me and my class and my subjects”, or “when I sit with my colleagues – how do you do it? – I did like this – I did as you did, but that didn’t work at all – No, but in my group it worked excellent – what is the difference between these groups?”

In the next category, justification of practice, we have found two different kinds of justifications: validation of the teaching by the pupils as illustrated by “when you can see how a candle is lit when you talk about different things” and by verification by a trusted authority or colleagues: “when you go to a good lecture… and you feel yes, I do that right” or “she pointed at several things which actually worked really well. She asked why I did this and that. It made me grow, yes… I felt I knew more than I thought” [referring to a learning study collaborative reflection session]. Only one respondent pointed out a course as a source of professional progression.

Interestingly enough, only 1 of 32 excerpts originated from the inexperienced group, 10 from the middle group and 21 from the experienced group. The experienced teachers had very clear ideas of how they develop their own competence, indicating many years of a reflective approach to their practice.

5.1.4 Organizational issues
Regarding organizational issues, 13 out of 17 respondents argued that time limitations is an issue; they feel there is not enough time to plan and perform their ordinary teaching appropriately, even less to improve their practices and learn anything new. Four respondents wanted to share the responsibility for their class with a colleague, and work more in pairs in the classrooms. The resource utilization category concerned how to organize substitute teachers, the documentation load, and to provide enough ICT equipment.

5.2 Experiences related to CPD activities
The second topic was divided into four categories: conceptual, experiences and opinions of CPD, insights and perceived influence.

5.2.1 Conceptual
Regarding the conceptual category, the respondents were asked to define CPD. 11 of the respondents gave their subjective definition on CPD. Five of these respondents gave a rather broad definition, illustrated by: “Something that makes me develop as a teacher” and “I guess that’s when you learn something different ... than what you already know” while four respondents referred to the content such as: “that you learn a subject better”. Two respondents referred to the design of CPD as illustrated by: “after all I still think of it as taking a course?” and “it is the different educations that you have.”
In seven cases, the respondents didn’t give a subjective definition on CPD but expressed other aspects instead. One of these statements was positive towards CPD while the other six were more critical. Two respondents said that they developed through collaboration, planning and discussing with colleagues, but that “it does not count as professional development”. One respondent expressed that “I do not feel any great need of it” and another said, “If there is something you want it is time, not professional development”.

5.2.2 Experiences and opinions of CPD

The next category, experiences and opinions about CPD, was divided into three subcategories: about organization, about form and about content. Respondent’s expressed criticism linked to CPD activities taking place without proper planning. According to one respondent there are problems related to staff being absent from work to attend a course or lecture. Replacement staff, or the lack of them, causes stress among teachers as well as pupils as illustrated by: “It has to be exceptionally good professional development if it is going to pay off for what has been lost in a couple of days where nothing substantial work has been done. So it, it is a dilemma”. Furthermore, the concept where some leave work in order to participate in CPD is also questioned for other reasons. There are deficiencies in terms of spreading knowledge to other colleagues as illustrated by; “Some attends these and some attends that. But it never comes to the attention of others, and then I don’t think that we can call it professional development”.

There are 53 statements categorized as “form”. The respondents gave several examples of potential forms of CPD, such as: workshops, study visits, job shadowing, learning studies as well as pedagogical and thematic conversation. Lectures and courses were given as examples of activities that could provide inspiration and make one reflect on one’s own actions such as: “a good lecture can make me reflect, a good lecture can matter a lot”. However, in seven cases the respondents stressed the importance of being able to apply recently developed skills into practice. In order to avoid a gap between theory and practise respondents requested hands on’ examples that they immediately could adopt in their work, as illustrated by: “and then you have to put this into practice and...I don’t always got the time” and “a lot is good but somehow you can’t use it.” One respondent specifically asked for interaction between CPD and work, where new knowledge is tested in real-life situations and afterwards discussed and evaluated. The respondents requested time to process experiences related to CPD as well as CPD organized to allow greater continuity and an opportunity to work with issues for a longer period of time. Peer interaction such as: discussion, collaborative planning and teaching were highlighted as positive form of CPD as illustrated by: “we know different things and then we learn from each other” and “there are actually a lot of knowledge between these walls”. On the other hand, unsuccessful examples of collaboration were also given, such as educational discussions without clear goals or meetings where a constructive dialogue was absent. In the next category the respondents gave examples of related to their CPD s such as implementation of the new school reform and ICT activities.

5.2.3 Insights

Next category “insight” aims to identify the consequences of CPD activities and
contains 18 statements in which 15 are critical and respondents express uncertainty of whether CPD is a good use of resources. The criticism partly regards lack of outcome or utility of CPD. The respondents lack obvious or visible effects and they experience difficulties implementing what they have experienced into practice, as illustrated by: “and then you’re back the next day, doing the same thing in the same way and I am not so sure that this is a good use of resources,” and “then it sounds really good but then two weeks passes... and then is has disappeared” and “I don’t think that I develop much when I attend to courses like these, I have been to way too many courses”. A critical approach towards CPD can also be linked to these activities taking place at the expense of other work-related activities. Respondents express that too much is “going on” which is stated by: “It feels like you could have a fulltime-job doing all of these other things, but then, you should still devote six hours on the kids every day”, “All the time its something new, before you’ve had the time to establish it in... in oneself.” and “teachers are very tired of everyone who attends to courses all the time. And it is the same thing with our principal who goes to courses all the time. That we miss our principal.

5.2.4 Perceived influence
Regarding perceived influence the decision-making process was partly questioned and activities lack support among the teachers: "Well, it is a whole lot that the principal has decided”. Respondents highlighted the importance of actually being involved in the decision-making process regarding CPD: "So you have to decide for yourself what professional development you need. I know what shortcomings I have as a person”. Two respondents stated that they lacked the determination or energy to be involved, as illustrated by: "I could probably be more involved if I had any time and energy left for it” Eight respondents said that they, together with the principal made decisions about CPD activities. This may involve influence to influence the content, choose between alternative activities or making requests, for example selecting from various options or making requests about the future, such as “you can come up with suggest yourself, but then it is still the principal who makes the decision”. The last category “can you decline CPD” includes eight statements. Seven of these conveyed an ambivalent response as illustrated by: ”Yes I think that I would be able to do that if I, but I think that you probably won’t” and “You can, can’t you? Yet it would feel unwise.” and "...yes I guess that you probably can. Well of you got a reason.” One of the respondents, however, clearly stated that he had no desire to say no: “I don’t want to say no...it is probably hard to manage without it. Because the reality changes all the time, new things show up, I mean this with computers which have expanded more and more and this new program that’s coming”.

6. Analysis
The respondents were clear about what they need to progress in their professional actions: they need time to teach, time to reflect on their teaching and they need to collaborate and discuss in particular locally rooted, didactic matters with their peer colleagues. From time to time they need to be inspired, but if there is no opportunity
to deploy the new ideas in practice shortly after, there will be no effect. The teachers expressed needs are well aligned with CPD methods advocated in research literature, recall from above: collegial collaboration, continuity, classroom observations, reflection and experimentation as success factors in CPD e.g. [11] [30] [31] [20]. But respondents, also describe when learning does not occur and that they lack visible effects of various CPD initiatives. From the interviews, however, a clear discrepancy could be distinguished, between what teachers perceived they need in order to develop and their experiences of CPD. When the respondents refer to learning activities they’ve been participating in, these actions are generally of occasional character, as readings or courses that take place in settings separated from school environment. This is consistent with previous research that shows how single development days often have a limited effect [19]. The respondents also stated that CPD often lack continuity, follow-up, local establishment, and that newly acquired insights were considered difficult to put into practice. The gap between expressed needs and actual interventions may involve difficulties in creating professional development.

What is also clear from the interviews was that the teachers are experienced a lot of pressure. New curriculum, more teaching hours and increased demands in documentation leads to a stressful work situation. Teachers described how they could not find time for their primary tasks at the same time, as there was a density of projects and concurrent learning activities. In such situation, not only did the utility of CPD activities become questioned, but also far more serious - in several cases was regarded as something taking place at the expense of ordinary work. In this context it not hard to imaging that teachers mobilize what Illeris [36] term as resistance or defense, since the feeling to be in a situation perceived as overwhelming activate this behaviour. Herein, Piaget’s [37] concept about cognitive equilibrium can help interpreting the teachers learning perceptions. From his view [37] there are mainly two outcomes of such cognitive equilibrium: either by ignoring new information, or by modifying previous knowledge. Choosing the path that involves a modification and transformation may require hard work and mental energy. The learning process might be regarded as a necessity but also associated with discomfort, stress and insecurity. This ambivalence was evident among the interviewed teachers, especially when the teachers reasoned whether they could refuse CPD initiatives or not.

Thus, at the same time as, the respondents emphasized their need to collaborate, discuss and participate in activities with colleagues, the importance of activities based on the individual's needs are also highlighted. Inferring individual circumstances is seen as a prerequisite for professional development. In order to avoid what Illeris [36] term as barriers of learning, CPD needs to be designed to support teachers in this work as much as possible. This involves that decisions are consolidated amongst the teachers and that learning activities is in line with the individual’s capacity.

It is clear that needs, as well as preferred learning methods, vary among individuals, but also between the different experiences amongst the groups. Learning preferences regarding concrete CPD activities seem to be individually based, whereas their preferences concerning professional growth vary among the groups. The most experienced rely mainly on their own ability to self-reflect to improve their practices but they also express a clear value and desire to collaborate and discuss with their colleagues. Yet they seem more aware of how challenging the teaching practice is.
This may indicate that teachers are open to learning to a larger extent and that they become more secure in their role with experience and thus less likely to prevent learning. On the other hand, the inexperienced respondents did not express much concern of current professional growth; on the contrary they expressed confidence in what they already know and an urge to put their competence into action. Such stance could indicate that this group even further experience the situation as overwhelming, and therefore mobilizes a defense. Defense and resistance can in this context be seen as an entirely necessary process from the perspective of the individual teacher, but hardly desired from the perspective of CPD. As Illeris [36] states adults are unwilling to learn what they cannot see the use for and when forced to change - their adjustment becomes superficial and activates defense mechanisms. Locating what Brophy [38] refers to as the proximal motivational zone, may consequently prevent learning barriers and be an important step towards successful CPD.

8 Concluding Remarks

To conclude, a clear discrepancy could be distinguished between what teachers perceived they need in order to develop, and their experiences of CPD. Furthermore the respondents experiencing a stressful work situation and requests more time in order to progress in their professional roles including preparing lessons, reflect on their teaching, collaborate and discuss didactic matters with their peer colleagues. Thus the respondents express ambivalence participates in CPD and the utility of these activities is being questioned.

The teaching profession is described as constantly changing and thus lifelong learning includes not only pupils but also teachers. Learning seems to become a requirement rather an opportunity. The teachers may experience the situation as overwhelming and therefore mobilise learning barriers. To avoid resistance and defense from preventing learning, it is important to regard the needs of the individual. Earlier initiatives may have been too uniform to enable learning for individual teachers in particular, as well as to adopt CPD methods in general. From this we can realise that further investigation is needed, taking a more integrated approach to consider such individual as well as organisational issues.

The results contribute to important insights relative to the direction of the further PhD project, regarding how to reach a sustainable subject-based ICT-competence for all teachers, in order to achieve generally ICT-competent schools in Sweden. The importance of meeting the teachers' individual needs is further enhanced in the light of previous research that has shown that teachers’ enthusiasm and competence of using ICT for novel teaching vary greatly.
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The Value of Embedded Technology Enabled Digital Services: A Study of Vehicular Remote Diagnostics Services

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Abstract. This research-in-progress paper shows the importance of investigating the value of the digital services that are enabled by digitalization of previously non-digital physical products or services. As the digital services are coupled with non-digital physical products, we argue that these digital services can create value in a different way and thus require more attention. We are conducting research on remote diagnostics services that are enabled by embedded technology in vehicles. With the help of layered architecture of digital technology, our initial findings show that value can be created in different ways at different layers of remote diagnostics services.

Keywords: Remote Diagnostics Services, Digital Services, Value, Digital Innovation.

1 Introduction

Many manufacturing companies are now providing services using embedded digital devices in the manufacturing products [1]. One such industry is the vehicle industry. There are research initiatives in Europe to embed digital devices inside vehicles and remotely diagnose the faults in various parts of the vehicles [2,3]. With this type of technology, a vehicle manufacturer gets the opportunity to offer innovative digital services related to vehicle maintenance to its customers. The services also reduce the possibility of breakdown of customers’ vehicles [4]. In this way, the digital services can create value both for the vehicle manufacturers and their customers.

However, digital services embedded with physical products are different from other services. Wise and Baumgartner [5] categorized these kinds of embedded digital services differently from the other services that the manufacturing companies provide in addition to their products. It has been argued that digital services create new opportunity for value creation and help a company to gain agility [6]. Moreover, Yoo et al. [7] also state, “digital technology’s transformative impact on physical products has remained surprisingly unnoticed in the IS literature (p. 725)”. Based on these arguments by Wise and Baumgartner [5], Sambamurthy et al. [6] and Yoo et al. [7], we can say that it is important to study the value aspect of digital services enabled by embedded technology in the non-digital physical products. This provides motivation for our study. The research question addressed in this paper is therefore:

What is the value of digital services that are enabled by the digitalization of non-digital physical products?
To answer this question, we investigate an empirical situation where a vehicle manufacturing company in Northern Europe is aiming to bring innovation in its vehicle maintenance services through remote diagnostics technology. In remote diagnostics technology, digital devices are embedded in the vehicles and the devices monitor and diagnose problems with various vehicle parts. This will reduce the possibility of breakdown by predicting faults in advance. With the help of this technology, the company is expecting to offer innovative digital services related to vehicle maintenance. We shall study the value aspect of these digital services.

The paper is organized as follows. First, we look at the related literature on value creation that shows connection to innovation. Later, as our study shows an example of digital innovation, we discuss layered architecture of digital technology as an important aspect of digital innovation. We conduct action research as our research method. We describe the project that is connected to this study. Then we present our initial findings. The discussion section explains the initial findings in connection to the layered architecture of digital technology.

2 Literature Review

2.1 Value Creation in Innovation

The connection between value creation and innovation has been discussed in extant literature. Porter [8] argues that with the use of new technology, firms can create value when they develop innovative ways of doing things. Innovation activities have the potential to impact value creation. Value creation is connected to the innovation of the products and services that increases customer satisfaction when the customers use the products or the services [9, 10]. Following Schumpeter [11], Amit and Zott [12] also point out to the fact that innovation is the source of value creation. Greater customer value relies on a firm’s ability to innovate [13].

While discussing about technological innovation, Teece [14] explains how technological innovation can create value for a firm. Through the protection of property rights, use of dominant design and complementary assets, a firm can gain profit from technological innovation. A firm that focuses more than the competitors on technological innovation and gain more technological capability, gets more benefit than the competitors [15, 16]. Over the past few decades, with the implementation of information technology innovation, positive impact has been observed in banking sector, chemical industry and tourism [17]. Innovation through information technology can have a real impact in customer relationship management. Firms are now providing services through state-of-the-art information technology and getting closer to the customers. One such example is the case of Apple where the customers are given opportunity to choose their favourite apps from the app store [18]. It has also been observed in the past that innovative information technology helped firms in transforming their business and changing customer relationships [19].

Looking at the previous studies that show how innovation creates value to the firms, we can see the importance of studying the value creation aspect in technological innovation. Although the previous studies show the necessity of studying value
creation through innovative information technology, little is known about the potentials of value creation when a firm is innovating through embedding digital technology in its products.

2.2 Digital Innovation

Yoo et al. [7] define digital innovation as ‘the carrying out of new combinations of digital and physical components to produce novel products (p. 725)’. A necessary combination of digital innovation is that the new combination depends on digitization, i.e., the encoding of analogue information into digital format. The most important aspect of digital innovation is the application of digital technology. Digital technology follows a layered architecture [20, 21, 22]. The layered architecture of digital technology consists of the following layers: Device layer, Network layer, application layer and contents layer [7, 23]. The following diagram shows a pictorial view of the layers.

![Layered architecture of Digital Technology](image)

The device layer deals with hardware and operating systems, network layer manages logical transmission and physical transport, application layer provides application functionality that directly serves users during storage, manipulation, creation and consumption of contents. The content layer contains data such as texts, images, sounds, video etc. Because of the continuous digitalization of earlier non-digital products and services, this four-layered architecture of digital technology has become more expansively applicable for all types of digitalized products. Before digitalization, these four layers were tightly coupled together with a particular product boundary and in case of some purely mechanical products such as an automotive, these layers did not exist. As a consequence of the digitalization, these four layers will be decoupled or loosely coupled to a greater extent [7].
Combing components from different layers using set of protocols can create alternative digital products which is known as combinatorial innovation [20, 24]. Due to the combinatorial innovation, different layers in digital technology can be utilized by different set of actors. For example, Apple provides opportunity to the app developers to develop new application functionalities at the application layer. It is evident that the app developers have no connection with the design of main iPhone at the device layer. The users of iPhone are choosing their favorite apps from the app store. Thus, digital innovation is creating opportunity for the users of the technology to create value both for the service providers and the receivers. Moreover, digital innovation of products and services is creating new opportunities for value creation and it is necessary to be studied [1].

3. Research Approach

3.1 Method

Action research is used for this research. Action research aims at expanding scientific knowledge through solving practical problems [25]. The reason for doing action research in this research is to develop knowledge about the value aspect of digital services. Besides contributing to the knowledge on digital services, it will help the practitioners to make a better understanding of the value aspect of the digital services for their business. There are various ways of doing action research [26] and we are conducting canonical action research because of its rigorous nature [27]. At the centre of canonical action research, there is client system infrastructure. The client-system infrastructure is the specification and agreement that constitutes the research environment. It provides the authority, or sanctions, under which the researchers and host practitioners may specify actions [26]. Canonical action research consists of five phases [26, 27]:

The first phase of canonical action research is the diagnosis phase. It corresponds to the identification of the primary problems that are the underlying causes of the practitioner’s desire for change. This diagnosis will develop certain theoretical assumptions (i.e., a working hypothesis) about the nature of the organization and its problem domain.

Researchers and practitioners then collaborate in the next activity, action planning. This activity specifies actions that should relieve or improve the primary problems. The discovery of the planned action is guided by a theoretical framework.

Action taking then implements the planned action. The researchers and practitioners collaborate in the active intervention, causing certain changes to be made.

After the actions are completed, the collaborative researchers and practitioners evaluate the outcomes.

Specifying learning denotes the on-going process of documenting and summing up the learning outcomes of the action research cycle. These learning outcomes should constitute knowledge contributions to both theory and practice, but they are also recognized as temporary understandings that serve as the starting point for a new cycle of inquiry.
3.2 Project Setting

This paper addresses an action research project jointly initiated by a bus manufacturing company SmartBus (Pseudonym) in northern Europe and researchers from a university to explore the area of remote monitoring and diagnostics of the buses. With the development of the remote diagnostics, vehicle maintenance business of SmartBus is expected to be expanded. It is also expected to help SmartBus to provide innovative services to its customers. Currently, the business of SmartBus is very much focused on selling buses. They provide some maintenance services to their customers when they sign service contracts with the customers. According to the current service contract, the company provides services to their customers’ buses in every 3 months or 6 months. The maintenance services include changing different parts, and do some other required operations so that the buses keep working. In spite of doing all these maintenance services, buses still have unexpected breakdowns. So, there is a need for the company to come up with a better idea for a more effective and efficient bus maintenance that can make it more service oriented. Remote monitoring and diagnostics seem to be a technology that can fulfil that goal to a large extent. This is the motivation behind the project. There are two aims of the project. First, to implement systems that will enable monitoring of the vehicles remotely, predict the faults in advance and diagnose the faults so that necessary steps can be taken before any breakdown occurs. There will be embedded devices with the vehicles that will predict faults and send diagnosed signal wirelessly to a remote station where technicians can be able to take next necessary decisions. Second aim of the project is to develop services out of this new technology. As the remote diagnostics technology opens the doors for providing vehicle maintenance services based on embedded digital technology, it seems important to identify and develop the services that can fulfil the customer needs. Neither SmartBus nor the technology developers themselves can identify all the customer needs. So, we find it necessary to converse not only with the people from inside the company, but also with the potential customers of these innovative digital maintenance services to gain a deep understanding so that maximum possible services can be developed with the help of the technology.

The members of this project include three informatics and three technical researchers from academia, three technology developers, two service developers and a project manager from SmartBus. The authors of this paper are among the informatics researchers who actively take part in different activities. We conducted number of various activities in order to collect data together with different participants from the vehicle industry. These activities include meetings, workshops, interviews, observations, market analysis and e-mail correspondences.

Public transport operating companies are among the customers of SmartBus. To gain customer perspectives, we conducted workshop, interviews with the traffic managers, service technicians and the drivers of three public transport operating companies.

The following table shows the participant and activities during data collection.
### Activities

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<tr>
<th>Service development meetings (Biweekly and on-demand)</th>
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<td>Project Manager (1)</td>
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<td>Technical Researcher (1)</td>
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<td>Informatics Researchers (3)</td>
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<th>Workshops</th>
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<td>Informatics Researchers (3)</td>
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<td>Traffic manager (1)</td>
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<td>Drivers (2)</td>
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<td>Service technician (1)</td>
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<th>Monthly Project Meetings</th>
<th>Service Developers (2)</th>
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<td>Technical Developers (2)</td>
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<th>Interviews</th>
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<td>Traffic managers (4)</td>
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<td>Drivers (5)</td>
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<table>
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<th>Documents (Meeting notes, weekly Project reports, mail correspondence)</th>
<th>Service Developers (2)</th>
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<td>Informatics Researchers (3)</td>
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<tr>
<th>Market Analysis (information regarding various competitors, obtained mostly from the web contents)</th>
<th>Informatics Researchers</th>
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### 3.3 Data Analysis Strategy

In the data analysis process, as data analysis materials, meeting notes from service development meetings and monthly project meetings, the transcription of interviews and workshops and the documents are used. The materials are coded using the qualitative coding types described by Richards (2009). Three types of coding such as, descriptive coding, topic coding and analytical coding and he emphasizes that all three types of coding are required for a passage of text (in an interview transcript or meeting notes). Descriptive coding allows the researcher to store the information about the speaker (in our case, for example, a traffic manager in a bus operating company). Topic coding allows to code the topic that is being discussed in the text. Topics such as, repair, cost, time, maintenance etc are used for topic coding when the texts are coded. Finally, analytic coding helps us to identify what’s going on in a passage of text, i.e., identifying several themes that are worth noting. According to Richards (2009), the analytic coding finds out categories that are not known before.
4. Initial Findings

We start our action research by investigating the existing situation on bus maintenance. The aim is to identify the problems of existing maintenance activities and the potentials for remote diagnostics. From service development meetings and monthly project meetings with the project members, we have understood that the technology developers are trying to analyse and solve the problems that they think are critical. Their identification is based on data from a previous project. We have found that it is important to discuss with a maintenance service manager in the organization. He emphasized that the current maintenance activities are not time and cost efficient. There are lot of unnecessary maintenance works even if they are not required. It happens because of the service contracts. As he states:

We have to change engine oil and other things on a scheduled basis as per the contract. The changes are not often required but we do it. That is one of the activities of scheduled maintenance. Buses are brought to us and we do some routine checks and changes. It will save time both for us and the customers if a system can predict faults in a particular part. Their buses will be in operation until it is really important to do some maintenance works.

Although SmartBus offers maintenance service to their customers, only 20% of their customers have signed service contracts. That makes things difficult for SmartBus to get information regarding most of the buses that they sell. A business area representative says:

Many public transport companies have their own workshops. They do not feel the necessity of signing service contracts with us. Probably, they do not find our contracts attractive enough. We need something like remote diagnostics to make the service contracts more sellable. We have different kinds of service contracts. Remote diagnostics can be offered with one of our contracts.

The information gained from the remote diagnostics can be helpful to develop services that the company can use to build customer relationship. They will not only be able to control the digital information but also decide what services they should provide. A service developer says during a meeting:

The back-office can be able to see the signals coming from the buses and based on the signals we shall see the condition of the buses. Any irregularity can be informed to the bus owners so that their buses can be saved from any possible breakdown.

There is problem with the existing technology inside the buses of SmartBus. They have a system called ‘Error codes’ they show error signals if something is wrong with the bus. However, the information from the systems is redundant and not trustworthy. A maintenance manager of SmartBus says:

Today we have systems to display error signals in the buses. But the signals appear very frequently on the screen in front of the driver and most of the signals are negligible and the drivers often skip them. Does an error signal mean that the bus should be stopped or can it be driven anyway? How can one identify the seriousness of a problem from an error signal?
Interview with the maintenance manager also reveals that current fault detection in the buses consume plenty of working hours. Based on the complaints from the drivers, the technicians assume the source of a problem. Then they try different things, change different parts until the problem is solved. When the problems is finally solved, it still can be difficult to identify the source of the problem as during the repair or maintenance activities lots of processes are followed and some parts are changed. The problem might exist in any of the parts or the problem has been solved during any of the work processes. The maintenance manager compared it with detective work:

*The reason for a problem sometimes is not that straightforward. Sometimes we need to do a lot of detective works. The drivers sometimes indicate to a source of a certain problem and we identify totally a different reason for that problem.*

He also mentions about the reliability issue of an existing system:

*We have system to check tyre pressure but it is not standardized and very expensive. It is not quality assured to be installed in all buses. That is why we check the tyres manually.*

Although the maintenance manager points at one or two problems regarding bus maintenance, the technology developers need to know more about the problems so that they can solve them with the help of remote diagnostics:

*The main issue here is that we need to know different types of problems that occur in the buses so that we can take initiative to solve the problems through remote diagnostics. This will create opportunity for developing different services based on this technology.*

From the discussion with the people inside SmartBus, we realize that the existing maintenance procedure is not cost and time efficient. The existing technology is not reliable. Moreover, the technology developers do not have adequate idea about what problems to address with remote diagnostics. They do not know how the technology can create value for them as well as for their customers as they have contact with very few customers after they sell the buses.

We decide to contact some of the customers of SmartBus to understand about the problems in maintenance and their thoughts and expectations from remote diagnostics systems. Before that, the technology developers discuss the remote diagnostics technology and its potentials during the monthly project meetings. It helps us to get a deep understanding about the technology and its potentials. One reason behind getting the information about the technology is to understand how it can help SmartBus in their business. Another reason is to explain it to their customers so that they can identify its value for their business. The action planning phase is guided by the layered architecture of digital technology. We plan to identify the value creation with respect to the layers.

We plan to discuss with the customers regarding bus operation and maintenance. The public transport operating companies are among the customers of SmartBus. Our plan is to involve the traffic managers, service technicians and drivers of some public transport operating companies in our activity so that we can get information about
how public transport companies operate and maintain their buses. In this way, we can identify the customer needs and inform it back to the technology developers.

We had meetings with the technology developers. They explain that the design of the main device of remote diagnostics is based on a specific algorithm and the algorithm is patented. From that point of view, the device is brand specific. Other companies are not allowed to use the algorithm. It gives a competitive advantage. A technology developer says:

*The device is only applicable for the buses manufactured by our company. It cannot be used in other brands. So, it is very much a closed system.*

Our market analysis shows that some other companies also have diagnostics tools for their buses. We ask the technology developers, ‘what is special about the remote diagnostics technology that you are developing?’ They explain that although there are some diagnostics tools available in the market, the technology of SmartBus will differ in a certain way. One of the technology developers explains:

*Most existing diagnostics or error detection systems are not on-board diagnostics tools. There is a requirement for analysis of the error codes by some experts. We are implementing a system where the diagnostics will be done by the main device in the bus and it will send an analysed signal about the irregularity. No more expert analysis will be required.*

When we start discussing with the personnel of a public transport operating company, they reveal some problems regarding few specific parts of the bus. A traffic manager says:

*We often encounter problems with the gear boxes. I don’t know whether it is common among the buses of SmartBus, but it occurs quite often.*

Apart from the problems with gear box, the personnel of the public transport operating companies also discuss about the problems with doors. It seems to be annoying the drivers. One of them mentioned:

*Sometimes doors don’t get closed automatically as they normally do when the button is pressed from the driver’s panel. It can be a real headache. Drivers should not drive the bus with the doors open. It is not safe. Something should be done with the doors.*

Once a contact is established between SmartBus and one of its customers (a public transport operating company), the technology developers start using some of the customer’s buses to embed the device to obtain data for analysis. It is a major step taken by SmartBus as they require real buses to do the experiments with the technology. A comment from a developer during a meeting:

*We would like to get some real data from the buses. Hopefully, the device will receive signals from various electronic control units (ECU). The initial signals that we will get will be really helpful for analysing the patterns of different parts of the buses.*

Besides using the buses for experimental purposes, the developers also start looking at the service records at the operating company. This helps them to understand the
maintenance activities that have been conducted over the past few months. They get some idea about the parts of the bus that require most repair or maintenance.

Later, we conduct a workshop with the personnel of another public transport operating company. They are asked to draw futuristic scenarios with the use of remote diagnostics systems. The motive behind the activity is to understand their expectations from the technology. A traffic manager, a service technician and two drivers participated in the workshop. They find out few issues that they think can be solved by remote diagnostics. First, they refer to the door problem. They suggest an innovative solution to the door problem with the use of remote diagnostics. Second, they suggest a solution to the problem that occurs with the monitoring of ticketing system.

An interview with a traffic manager of another operating company points at few other issues. We find that fuel consumption can be monitored with the use of remote diagnostics. There is difficulty in understanding the problem patterns of the buses. Moreover, driver behaviour can also be monitored with this technology. Many other problems are also mentioned by the traffic manager. While discussing about the potential of remote diagnostics, the manager mentions:

*Based on the information obtained from remote diagnostics, it will be easier to do the route planning. If a fault is predicted before any breakdown occurs, we can plan to deploy another bus on that route.*

5. Discussion Based on Initial Findings

Our initial findings suggest that due to the patented algorithm and property rights, the digital services can create unique value for the firm that provides the services. This value creation takes place at the device layer of the layered architecture of digital services. When a digital device is designed in a way that it can only be embedded in the physical products manufactured by a specific firm, the device can create value for that firm as other firm cannot use the same device. This adds to the discussion of Teece [14] who argues that property rights create value in technological innovation. Our study shows how it creates value for digital services obtained through innovating physical products. During digital innovation, value creation can occur at the device layer through property rights. Our study also shows that with the use of embedded digital device in a physical product, the product quality can be improved. This happens when the firm gets information from the device regarding the functioning of the product. Any deficiency in the product can be reduced through a new approach in developing the product.

The firm and its potential customers can co-create services at the application layer and the content layer. In a B2B setting, as in the case with our empirical situation, the firm can co-develop and co-innovate the digital services with existing or potential customers. The application layer consists of the application functionalities. The technology developers design the applications. As we have seen from our findings, the customers can discuss their existing problems related to the product and the technology developers can address the problems when they are designing the application functionalities at the application layer. The technology developers attempt to solve the problems identified by the customers. This process can be referred to as
co-development [28]. Moreover, our findings suggest that the customers come up with innovative ideas that can be useful in the service design. This particular example can be called co-innovation. Thus, co-innovation provides the opportunity to the potential customers to co-create the digital services. This is an example of value co-creation as co-creating with customers is referred to as value co-creation [29].

As the receiver of digital services, specific value is created for the customers at the content layer. Customers own the physical products and the digital devices are embedded with the physical products. Our initial findings show that in the case of services obtained through the embedded digital technology, the customers can use the information to take decisions that can positively affect their businesses. Moreover, the embedded technology helps to improve the condition of their products.

6. Future Plan
Next plan is to look at the value aspects of the remote diagnostics services more in detail with the four layers of digital technology. Initial findings gave us some idea how value is realized in some layers. However, as we shall investigate more into it, we shall be able to find more value aspects of remote diagnostics services at the device, network, application and content layers.

References


Regulatory Complexities for Patient-Oriented e-Services in Norwegian Healthcare

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Abstract. The paper explores regulatory insolvencies and gaps (complexities) in the present-day Norwegian legislation around patient-oriented information systems in healthcare. Complexities characterize “problematic” institutions in the current Norwegian law, which evolves in dynamic together with patient-oriented concept of e-services. This paper is a grounding piece for the subsequent work, which shall show how the four cases of patient-oriented services emerge and develop in the challenging regulatory environment. However, the technologies correspond to laws and policies by their practices and emerging organizational forms. This work is aimed at mapping of regulatory complexities for the purpose to study interaction between the case study technologies and the current regulatory environment.

Keywords: regulatory environment, patient-oriented e-services, law, policy, information systems, complexities, Norway

1 Introduction

The work investigates the regulatory environment (laws and policies) around existing patient-oriented information systems in healthcare in Norway. My purpose is to determine and map the main regulatory complexities (insolvencies, gaps, collisions, ethical issues, etc.) as “nodes” of potential responses to them in practice by technologies with a patient-oriented approach in healthcare. As Lanzara claims (2009:37), in the process of design, the technology has to be “enclosed within a normative shell” or be “normatively assisted”, otherwise it cannot be established in normative sense or enacted within the existing framework. However, the regulatory environment is not perfect, since it is developing in the ongoing process of interaction with the object of regulation by encompassing its general characteristics (Seipel 2004). In other words, laws and policies as regulatory environment “learn” from the technologies and evolve with them simultaneously in the process of interaction.

The Norwegian Government expects the emergence of a common national e-health infrastructure in several years. The approximate picture of such infrastructure is preliminary described in Communication to the Parliament number 9 “One resident – one journal” (i.e. Melding til Stortinget “Én inbygger - én journal: Digitale tjenester i helse- og omsorgssektoren”, 2012 - 2013, further – Meld. St. 9 “One resident – one journal”), which is issued on November 30th, 2012. This policy document indicates
problems, challenges, aims and principles for establishment of a well-organized coordinated patient-oriented information infrastructure in healthcare, which shall interconnect local information systems of health institutions, health databases and other IT-solutions in the sector for the sake of patient-oriented approach. According to the view expressed by the Government in Meld. St. 9 “One resident – one journal”, such a coordinated infrastructure shall result in better treatment and improvement of social welfare. However, the aims of the policy explicitly imply the increasing complexity of norms, practices, values, organizational forms, etc. in the due course of the development of the national e-health infrastructure. This complexity of technological and practical coordination is challenging for the evolving legal environment. The legal environment, besides the expected need to evolve, embeds internal problems and inconsistencies. However, technologies also undergo sophisticated challenges to develop means and solutions to users’ needs in the healthcare domain. Technology and law are two regimes, which both have regulatory power. In their mutual relation they generate number of problems in accountability, efficacy, authority, legitimacy, fairness, etc. (Contini and Lanzara, 2009).

My major interest in the research project is to understand how the interaction between laws and technologies happen, i.e. how the space between the Norwegian laws relevant to the healthcare sector and emerging information technologies with patient-oriented approach look like, why and what patterns of their dynamic interaction are observed. The interest of this paper, however, is to take a close look at the regulatory environment of laws and policies towards information systems with patient-oriented approach, the insolvencies, dilemmas, vagueness, gaps or collisions of the current relevant laws as environment for technologies, which are to develop in accordance with expectations to them found in policies by the Government. The public sector influence to the technologies is significant, because the Government claims the principle of centralization and coordination as grounding for e-health.

However, patient-oriented approach is the aim, which both regulatory environment and technologies are supposed to co-evolve to. This approach in healthcare might be understood e.g. as empowerment of individual user by providing him/her with more choices, ensuring the feeling of respect and human dignity, specifying tools for participation in decision-making and exercising the rights (Fisher et al. 2005:106). However, as of year 2013, the old provider-oriented approach in information technologies in the Norwegian healthcare is dominating over the patient-oriented approach. The old one implies high participation of the healthcare providers in the decision-making about the patient health. The new approach shifts significant piece of such decision-making power to the patient. This shift raises the issue of patient rights and forms of information management under the patient-oriented information systems approach.

Subsequent research will show up how the regulatory complexities are dealt by the emerging and existing patient-oriented information systems as case studies. The case studies are the official public portal Helsenorge.no (further – Helsenorge.no), a web-based portal for patient-hospital communication My Health Records (further – MHR), an emerging IT-solution for better organization and sharing of the essential patient data (such as drug use and severe allergies) among the treating healthcare personnel with a limited set of patient-oriented functions - the National Core Journal (Nasjonal Kjernejournal), and a private IT-solution for easy and fast uploading and sharing of
2 Literature

As it was mentioned in the section above, technologies and law represent two huge regulatory regimes, which generate varied problems in accountability, efficacy, authority, legitimacy, fairness, etc. (Contini and Lanzara, 2009). Kallinikos (2009) defines regulative regime as “a technical, social, institutional system of forces that shape human agency both in the direct way of embodying functionalities that engrave particular courses of action and in the rather unobtrusive fashion of shaping perceptions and preferences, forming skills and professional rules.” In other words, in the clash of the regulatory regimes of law and technology we expect to observe emerging functionalities, perceptions and preferences shaped by numerous human agencies involved in the regulatory regimes, conducted actions and negotiation processes. As Koops, Lips, Prins and Schellekens (2006) claim, technologies demand to be regulated. In literature, regulation is understood in different ways depending on the chosen perspective. Lessig (1999) states that a new technological creation may lead to elaboration of a completely new institutional order, and by such a technology he means Internet. Later on, Lessig (2004) develops the model of code, which is “regulation” of technologies shaped by practice and ethical norms, legislation, market demands and needs, and technological architectures. This concept of regulation can be used for the analysis of information systems’ shaping towards the whole complexity of environment and national contexts.

Since my focus in the general research is aimed at case studies and is limited in the framework of techno-legal shaping, I am looking primarily at the “micro-world”, the level of teams and groups developing the technologies in the case studies. As Barry (2001) notices, the “micro-worlds” consist of specific work practices, institutional principles and techniques, which are capable to re-configure the space of government. The regulatory complexities discussed in this paper belong to this “space of government”. Thus, I am interested in figuring out the connections between the regulatory complexities and the emerging/developing patient-oriented technologies, since these connections determine the field of their bilateral shaping and co-evolution. In between technologies and law we expect to find new institutional capabilities, which Lanzara (2009:36) calls communication channels among authorities and agencies in the framework of the gradual loss of bureaucratic control and spread of “administrative disorder”. Patient-oriented approach in information systems seems to be emergent from such disorder. However, this is a new object for law to react to. Seipel (2004) claims that in the due course interaction with technologies, law encompasses the general characteristics of information technology such as automation element, logic, organization, activities, etc. In order to correspond to emerging technologies, law needs this interaction. Seipel (2004) states also that law shall not aim at regulation of technologies, because that is likely to be a hinder than a help. Instead, law shall focus on regulation of the use of technology. As Kallinikos (2009) fairy notices, design and use of technologies are interrelated in varied complex ways. These ways have to be disentangled conceptually and studied empirically.
3 Research method

In order to determine and explain complexities in law, I read relevant legal acts and conduct textual analysis. The basic idea with the textual analysis is to understand the meanings behind the text and assumptions of the data in case if the authentic resource is of high importance (Lacity, Janson 1994). In this paper the authentic resource is very important, because I try to find and reveal the content of the regulatory complexities found in the current legislation in Norway. The regulatory character of the studied environment implies our reference to the authorized public structures such as Parliament issuing laws and Government issuing policies.

Besides laws, I use the policy material issued by the Norwegian Government and addressed to the Parliament as guiding documents with the general principles of what the information systems in e-health shall strive for. A preliminary comparative analysis of the case studies of the four patient-oriented information systems shall show what paths to unveil the complexities the subsequent case study research will likely to take. This strategy is applied to study how technologies are capable to influence law and corresponding regulations by creation of new institutional order Lessig (1999). It will be possible to develop in the subsequent research aimed to understand the interaction between law and case studies separately.

4 Cases and regulatory complexities

Even though the idea of a common patient-oriented e-health information infrastructure is already not new, its practical development raises many questions in the regulatory domain. The document Meld. St. 9 “One resident – one journal” states the principle that the existing and emerging IT-solutions for health shall operate in coordination fruitful for the common national e-health infrastructure. This infrastructure is expected to be visible by 2017. Even though I do realize that the development of such an ambition project will take decades and might not necessarily resemble the vision, which is found in 2013, but the idea of the corresponding policy material is an attempt to “synchronize” the regulatory (especially legal) environment with the increased technological development and users’ needs. Therefore, policy documents are worth attention to reflect on laws and vision of the technological collaboration. Below I introduce the cases and their basic differences to show the

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1 In this paper I use the English translation to the Norwegian laws and regulations. The English translation comes from the short title of the laws and regulation as it is stated by the Parliament. Full titles of the legal documents are given in the list of references, which I begin with the English translation. These are: the Act on Health and Care Services (Helse- og omsorgstjenesteloven, i.e. Lov om kommunale helse- og omsorgstjenester m.m.), the Act on Patient and User Rights (Pasient- og brukerrettighetsloven), the Act on Health Personnel (Helsepersonelloven), the Act on Specialist Health Service (Spesialisthelsetjenesteloven), the Act on Personal Data (Personopplysningsloven), the Act on Health Registries (Helseregisterloven), the Bylaw on Journals (Journalforskriften), the Bylaw on Cross-Area Patient Journal (Forskrift om virksomhetsovergripende pasientjournal) and the Bylaw on the National Core Journal (Kjernejournalforskriften).
contrasts in their approaches to the patient-oriented concept at the background of the existing regulatory environment. As it was mentioned above, among the case studies there are three as the IT-solutions developed by the public sector (Helsenorge.no, MHR and the National Core Journal) and one private initiative (My Health Book).

4.1 The official public portal Helsenorge.no vs. user rights

Helsenorge.no has been designed to exercise the right of individual user and patient to information on health issues in accordance with § 3-2 of the Act on Patient and User Rights. However, this portal resembles general electronic “encyclopedia” about diseases and treatment, seasonal health vulnerabilities and basic rights of patients. The information found at the portal is checked by professional experts to be reliable enough for self-consultative purposes. As professionals at Helsenorge.no ensure, the information provided by the portal is better in quality than descriptions of health issues found by “googling” at forums and blogs.

By use of Helsenorge.no the individual user exercises the right to “choice between the available and appropriate investigation and treatment” granted in § 3-1 of the Act on Patient and User Rights, since the individual user may be get aware of what disease he/she is likely to have on reading information from the portal and compare it with their own feelings. However, the right to information about the own health condition and sufficient insight in the health service due to found risks and side-effects of treatment (as of the clause 6 of § 3-2 of the Act on Patient and User Rights) is not exercised by use of Helsenorge.no. This right requires the data analysis behind the given information to the individual user for subsequent decision-making. In terms of gaining and managing the personal health data by individual users, Helsenorge.no has only six e-services: “Order health insurance card” (“Bestill helsetrygdkort”), “Report side-effects” (“Meld bivirkninger”), “My deductibles” (“Mine egenandeler”), “My general practitioner” (“Min fastlege”), “My receipts” (“Mine resepter”) and “My vaccines” (“Mine vaksiner”). Moreover, many important healthcare databases containing patient data at healthcare institutions are not yet under coordination over Helsenorge.no. The back side of the portal is Helsenorgebeta.net, where there is a blog for feedback from individual users and patients, and updated information on IT-innovation in the sector. This function is designed for getting any feedbacks on technologies and health services, which are parts or prospective pieces of Helsenorge.no.

4.2 Patient-hospital contact solution MHR vs. patient as user & the legal relation with the policy domain

The second case, MHR, is a web-based portal for patient-hospital communication. It is developed on the initiative of a small team from the IT department of a large hospital in Norway. This IT-solution is designed to speed up the communication process in the processes of treatment, which may be a crucial factor for providing sufficient medical help. I would claim that MHR exercises to some extend § 3-1 of the Act on Patient and User Rights, where patients and individual users have a right to
actively participate in choosing between available and appropriate methods of examination and treatment, and cooperate actively in the treatment. Moreover, MHR exercises partly the provision § 5-1 of the Act on Patient and User Rights on the right to insight into journal, so that patients may get discharge summaries and laboratory results. However, in that case the individual user shall be a patient and be registered at a healthcare institution. Thus, MHR is designed predominantly for patients, registered sick persons, but not for usual healthy individual users.

One more interesting aspect in the case of MHR is that this IT-solution belongs to Norsk Helsenett SF, a state-owned association, which has an internal document of a legally-binding power for its members known as “Norms for information security: health, care and social sectors” (“Norm for informasjonssikkerhet: helse-, omsorgs- og sosialsektoren”, or “Normen”; further – “Normen”). This internal document provides a binding power to the flexible policy guidelines of “Framework for authentication and security in electronic communication in the public sector” (“Rammeverk for autentisering og uavviselighet i elektronisk kommunikasjon med og i offentlig sektor”) on information security level 4. Thus, MHR is regulated not only within the legal framework, but also within regulations of Norsk Helsenett SF, what allocates MHR into the double control.

4.3 The Core National Journal vs. essential data and the data controller

The third case, the National Core Journal, shall compile core records and make available essential information on patients across boundaries of health institutions and administrative levels. According to Meld. St. 9 “One resident – one journal”, the National Core Journal shall become a core technology of essential (critical) health data of the Norwegian residents. It won’t be a piece of Helsenorge.no, but the access to the National Core Journal will be provided through the official public portal Helsenorge.no. However, the National Core Journal shall first deal with an interesting legal challenge: according to the newest Bylaw on the National Core Journal, § 4, this information system is going to treat the following health data about the Norwegian residents without their consent: their name and ID-numbers; contact information to them and their representatives; the lists of drugs; critical information about allergies, implants, provided healthcare, etc.; data about all the contacts with healthcare institutions; references to varied health data including patient journals, test results, images; patient notes in free form; administrative information on reservations to access to health records, given consents, gained denials, log-in data of the third persons; and, if the patient wishes so, the data about ongoing treatment. This information is the most essential for exercise healthcare to a person, and according to § 2 of the Bylaw on the Core National Journal, the Norwegian Directorate of Health is a data controller, who determines the purpose of the processing of health information and the tools to be used (see reference to the clause 8 of § 2 of the Act on Health Registries).

Such an empowerment of the big public structure over essential health data of each and one in the country may be the reason for individual users to exercise the right to deny the creation of the Core Journal about them according to paragraph 3 of § 4 of the Bylaw on the National Coe Journal, where only the name and ID are given and the
reason for reservation against the Core Journal. How this complexity will develop in practice is one of my key concerns to research about in the framework of separate case study work. The testing version of the National Core Journal will be launched in autumn 2013.

4.4 My Health Book vs. private purposes with the personal health data

In contrast to the mentioned three cases, My Health Book is a private initiative. It is designed for easy sharing of health data between residents of Norway (not necessarily sick) and health personnel registered in accordance with the Act on Health Personnel. My Health Book is an application-based IT-solution providing data sharing between individual users and authorized health personnel via mobile devices and PCs. The case of this technology implies that the shared health data is in private property of the individual user, and the user treats it for the private purposes. Then such data is not considered as sensitive in accordance with paragraph 2 of § 3 of the Act on Personal Data. This norm states that the Act does not extend its power to personal data carried out by merely personal or other private purposes.

The problem is that there is a gap in the Norwegian law, which does not define the content of the right to property, such as right to own, enjoy and dispose the item, as it is found in international practice. Thus, as a regulatory environment of the files shared by My Health Book the regulation of immaterial property may be applied and the Act on Certain Aspects of Electronic Commerce and Other Information Services, which is an alternative and challenging domain for emerging e-services for healthcare in Norway. My Health Book, being such an alternative technology for data sharing, provides respective security level and user-friendliness as a main principle. The forms of interconnectivity of this solution with the cases above in future are under discussion by the designers.

These four cases, as it is shown, are also not unproblematic at the moment. The design of the technologies in the case studies and the direction of their evolution in the changing legal environment is of my research interest. The solutions of their governance structures may shape up functionalities and architecture of the common infrastructure in future. Thus, any problem of the case studies in the framework of the general regulatory imperfection is very important for my research to investigate how technology adapts and what feedbacks gives to the regulatory environment.

5 Other complexities in the regulatory environment

Below I would like to highlight and discuss some challenging issues, which I found in laws and is concerned to follow up in the due course of my work in researching about patient-oriented approach. Kjønstad (1999) claims that all rights of patients may be divided into the following categories: rights to become a patient (such as getting urgent medical help); rights that person gains on getting a status of patient (such as the right to choose a hospital); and procedural rights (such as the right to appeal in case of violation of granted patient’s rights). Winblad and Ringard (2010) add the
fourth “dimension”, i.e. time periods for the treatment of patients, which is very important for health condition and the choice of other rights. All these four categories appear in the subsequent search of regulatory complexities related to usual users/patients, electronic form of data, access issues, etc., which the chosen case studies can potentially meet and unveil in their development.

5.1 Becoming a patient & being a resident (“en innbygger”)

The right to urgent help is provided to individual user and patient by a commune, which exercises a standard service (verdig tjenestetilbud) under § 2-1a of the Act on Patient and User Rights and § 4-1 first paragraph b) of the Act on Health and Care Services. The latter provision duplicates the former and does not give a definition of “standard service”. That gap contests the nature of local IT-systems involved, which is important in the process of building interconnectivity as the main aim in Meld. St. 9. The second questionable issue is the right of residents to be in the list of a general practitioner in a Norwegian commune, including asylum seekers and their families being members of the National Insurance Scheme under § 2-1c of the Act on Patient and User Rights. Asylums shall have an access to “My therapist” (“Min fastlege”) at Helsenorge.no. According to Meld. St. 9, on having logged in the individual user will have access to all own health data stored at all systems containing them. However, no regulation so far determines such an access model and specific material and procedural norms in terms of such a user group, whereas the right to be in the list of a general practitioner is too general for them. Thus, no possible differences in journal options for IT are wherever described so far. I believe, the answers on how the technology is going to manage this challenge may be found in the technical architectural models of the evolving Helsenorge.no for the subsequent research.

Moreover, the status of patient is conditional in terms of the right to specialist medical help (spesialisthelsetjeneste) from the regional health authority, including immediate help, § 2-1a of the Act on Specialist Health Services. The person shall reside permanently or thereabout in a region. Thus, some categories of users without the permanent residence permit fall out this right. This provision is, however, to reduce cost burden on the Welfare State and prioritize long-term residents, who may become Norwegian citizens. However, the rights to become patient existing at the moment may be a factor for user-stratification in virtual reality of the emerging infrastructure within its basic concept “one resident – one journal” and lead to vertical user-profile fragmentation. This complexity may get a practical technological solution within a case study technology in a while. I will be able to discuss it in several months. This is a user-profile regulatory complexity. The directions of information infrastructure development may depend on legal status of users.

5.2 Patient journal, electronic patient journal (“en journal”) & data sharing

According to paragraph 1 of § 3-2 of the Act on Specialist Health Service, health care institutions, which exercise specialist healthcare, shall take into account the need for effective electronic communication by acquiring and developing their medical
records and information systems. The Act on Health Registries allows the electronic treatment of health data in § 5 with respect to all conditions towards processing sensitive data stated in § 9 of the Act on Personal Data, and the need of approval of such a treatment from the Data Inspectorate (Datatilsynet) stated in § 33 of the Act on Personal Data. However, the very definition of “electronic patient journal” (elektronisk pasientjournal) is missing in the Norwegian legislation. According to § 3 of the Bylaw on Journals, a journal is a collection of registered health information about a patient. One more definition, proposed by the Norwegian Directorate of Health (Helsedirektoratet), is given at Helsenorge.no. A journal is understood as a collection of information in electronic or paper form, which contains data on patient’s contact with health services on i.e. diagnosis, the course of disease, the treatment and information on other factors, which may be relevant (italics are mine) to the ongoing treatment or any subsequent treatment (Pasientjournal, http://helsenorge.no). Electronic patient journal might be defined in analogic way. However, according to paragraph 2 of § 6a of the Act on Health Registries, cross-institutional health registries (vilkosomhetsovergripende behandlingsrettede helseregistre) shall be kept electronically, and contain only specific health data in a limited scope (italics are mine) that is necessary and relevant to collaborative medical personnel to provide proper healthcare services to the patient or individual user.

The norm-definition of the in-hospital patient journal is “inclusive”, i.e. it norm includes varied types of health data. The norm on cross-institutional health registries is “exclusive”, i.e. it excludes “unnecessary” data. However, despite the fixed “exclusive” norm there is also the provision of the paragraph 2 of § 39 of the Act on Health Personnel, which states that in healthcare institutions there shall be appointed a person who has an overall responsibility for each record and for deciding what information shall be in the patient record. Thus, the structure of health data is in hands of local practices of health workers. Therefore, definition of electronic journal, which is deduced from the paragraph 2 of § 6a of the Act on Health Registries, § 3 of the Bylaw on Journals and from the proposal by Helsenorge.no need revision with the paragraph 2 of § 39 of the Act on Health Personnel. It may also be one of the factors for problems in developing IT-standards to health data for the technologies.

At the same time, § 2-4 of the Act on Patient and User Rights contains the right of patient to choose a healthcare institution, which may provide the necessary help. It means that the patient may not necessarily be treated at one healthcare institution. However, in case of cross-institutional (virkosomhetsovergripende) treatment it is only the data controller (databehandlingsansvarlige) or health professionals, who have documented the data, have the right to share the data with another health institution at the given consent of the patient (see paragraph 2 of § 45 of the Act on Health Personnel; § 13 of the Act on Health Registries). The law does not provide any requirement to the form of the shared data in cross-institutional treatment. It may be in hard paper copies or be communicated orally, or sent by usual post, or electronically if possible. This is the complexity of health data sharing.

In sense how the electronic form of the patient data and the sharing process is exercised the case studies demonstrate, how the complexity may be unveiled. The purpose of the National Core Journal is to provide electronic sharing of the necessary health data to exercise the required healthcare, and not to stimulate paper-duplicates, since then the requirement to information security by § 13 of the Act on Personal Data
might not be guaranteed (Etablering av Nasjonal kjernejournal, Høringsnotat, http://www.regjeringen.no). The second case, My Health Book, is a private patient-oriented IT-solution specifically aimed at health data sharing in electronic form. It is stored in the technical architecture of My Health Book, but not in the mobile devices of individual users, which are used for sharing. A unique code is generated by the technology as soon as the individual user chooses the option to share the data with a health worker. For the security reason the code may be communicated to the medical doctor orally. In order to get access to the shared health data, the medical worker uses the own user-profile with included HRP-number, which all healthcare workers have. The shared data is encrypted. The security level is high, but the health data has a status of the property of the individual user in accordance with the paragraph 2 of § 3 of the Act on Personal Data. This possibility though emerge from the right to copy granted by the paragraph 1 of § 5-1 of the Act on Patient and User Rights, which still implies the hard paper form of the health data issued to the patient at the request from his/her patient journal.

The security aspect of the health data sharing is one of the most principal differences between My Health Book and MHR. The latter follows the requirements of the highest level of security for the health data as sensitive information in accordance with the paragraph 1, 8), c) of § 2 of the Act on Personal Data and “Normen”, an obligatory document for MHR to follow as a member of Norsk Helsesett SF. The sharing capacity of MHR is lower in terms of types of the health data, but the security level is the highest and all corresponding laws on health data in the Public Law are applicable to MHR. These are possible technological paths to deal with the complexity of sharing. I think that their technological background may serve for elaboration of electronic patient journal concept as a collective concept.

5.3 The right to insight & processes

According to Meld. St. 9 “One resident – one journal”, the modern e-health instruments shall work on how to provide improved functionalities for decision-making in healthcare processes. Patient safety will be enhanced if healthcare workers will be granted better grounds for decision-making; information security will be enhanced by better management and monitoring of access to medical records. Here we see the triangle: patient safety, decision-making by healthcare workers, and healthcare processes. By empowering individual users to manage their own health (Fisher et al. 2005) there may take place the high risk of shifting responsibility for healthcare decisions onto sick persons, i.e. patients. However, at the moment we can already foresee the approximate path of the legislative development, which shall prevent such a dangerous scenario.

Meld. St. 9 “One resident – one journal” puts emphasis on the right to insight (innsynsrett) into electronic journal, which shall be improved for both individual users and healthcare workers. Users will be empowered to control the possibility by someone else to get insight into the patient journal (see p. 26 of Meld. St. 9), which I would call “negative consent” by user. At the moment, the insight to health data by the patient into the journal shall be approved by the health personnel, who exercises medical help (see paragraph 1 of § 41 of the Act on Health Personnel). The consent
for sharing the health data is not required until the data circulates within one healthcare institution. However, the data may be shared cross-institutionally by the data controller (databehandlingsansvarlige) or health professionals who have documented the data (see paragraph 2 of § 45 of the Act on Health Personnel). Then the patient consent is required. Subsequently created metadata on events of electronic shaping might be included into the list of sensitive data to complement the data on health. However, this is just an assumption, which needs empirical verification or disprove at example of MHR and Helsenorge.no.

According to Meld. St. 9 “One resident – one journal”, patients and individual users shall be actively involved in the process of their treatment. The right to insight into the journal, guaranteed in § 5-1 of the Act on Patient and User Rights, might be denied in case the competitive medical worker considers that the insight into the health data may worsen up the health condition of the patient. According to § 5-2 of the Act on Patients and User Rights, the patient or usual individual, whom the data is applied to, has the right to require the correction of the health data if the data is incorrect or wrong. However, if the decision to deny the insight to journal is based on the incorrect or wrong data, the patient or individual user is in vicious circle. This is obviously a legal problem, which raises a value dilemma whether the health personnel may decide on the denial of the insight. This is a difficult, unsolved regulatory complexity, which is in need of empirical investigation at examples of my case studies.

6 Conclusion

In the framework of this paper I have found the following challenges in the regulatory environment for the emerging and developing patient-oriented information systems in healthcare: complexities with exercising of the rights of individuals to the information about their health condition (requiring active assistance by the information systems in the data treatment to insure better decision-making, which is different from the usual “encyclopedic” approach to information), complexities with the right to insight into health data (relevant to the status of the resident; the health condition of the patient; professional skills of the health personnel authorizing patient for this right), complexities with the right to copy (hard paper versions of patient journals as grounds for photo-sharing within an electronic information system). Moreover, there are also complexities with the understanding of the patient journal (and hence, the character and use of the data there, and the forms of data sharing), complexities with regulation of the existing information systems (pure legal norms and legalized policy documents due to organizational forms in the management), complexities with the required level of security to sensitive health data (still allowing varieties of technical architectures of information systems), complexities with the data controlling procedures (monopoly of the public sector to essential health data of the Norwegian residents; patient consent issues preventing data flow; status of metadata) and complexities with the legal status of the health data (which is not considered as sensitive if shared for private purposes).
The complexities are not necessarily problems, even though the complexities may potentially contain them. Meanings with them vary. One of such meanings may be to provide involved “micro-worlds” of specific work practices, institutional principles and techniques (Barry 2001) with a fruitful environment for technological solution the space of possible technological trajectories of the best solutions in the framework of a case. The design of technology may contain an answer on how to deal with regulatory complexities assisting the ideas. The technology may become a precedent of a solution, just like My Health Book and the jurisdiction of the Civil Law to treat the health data for private concern.

However, the cases of bigger IT-solutions coming from the public sector, since they may face several complexities as it is in case of Helsenorge.no founding itself in between two regulatory regimes – legal and technological. The technical architecture of Helsenorge.no shall be capable to process and treat huge amount of data in a secure way and the patient-oriented strategy with the guaranteed execution of the patients’ rights by finding out really smart paths veiled in the involved complexities as “nodes” for possible solutions. It may take much more time than it was planned, but then we will witness the emergence of the regulatory regime in between legal requirements and pure technical model of a national e-health platform. This solution is likely to show unique organization of functionalities and perceptions shaped by varied human agencies involved in the overlapping regimes in performance of actions and ongoing negotiation processes (Kallinikos 2009). Some of the found complexities may be dissolved by themselves by practices and improved law, since law also “learns” from practices (Seipel 2004). However, new regulatory complexities may emerge. I do not exclude the emerging complex challenges coming to meet both the technologies and law from the improved medical practices.

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Framework for understanding ERP development ecosystems: business and technology perspectives

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Abstract. Strategic alignment between business and IT is considered critical for competitiveness. Enterprise system and business process reengineering projects are inter-related and have a major impact on strategic alignment. ERP systems are developed in multiple stakeholder ecosystems. Current literature does not provide sufficient support for this. The aim of this paper is to identify business and technology perspectives’ stakeholders. As a result, a combined framework of ERP development ecosystem stakeholders is created. The combined framework increases complexity and the number of stakeholders. Nevertheless, it offers a holistic view. Our framework offers implications for both literature and empirical research and also for IS practice.

Keywords: ERP development ecosystem, Business-IT alignment, enterprise system, business process reengineering

1 Introduction

Customer needs and business environment evolve continuously. In order to survive, also organizations must follow this transformation. Information technology (IT) is a part of this change, even though many issues need to be considered [1]. For example, from the strategic perspective, it is acknowledged that alignment between business and IT strategy is essential for organizations to gain competitive and strategic advantage, and to maintain it [2]. Yet the alignment is not seen as a fixed state or a single event, but as a continuous process over time [2;3].

To improve alignment is about changing the organization. This implies that social factors need to be considered. The impact of this change to both technology and processes and further to people, structure and management can be justified with almost any socio-technical change model [see e.g. 4;5]. Alignment is approached from two viewpoints: intellectual and social. Intellectual alignment focuses on organization’s plans and outcomes while social alignment addresses the issues with mutual understanding and commitment between IT and business people. Social dimension of alignment has been less explored. [6;7]

Strategic alignment includes both business and IT domains. Strategic Alignment Model (SAM) [3] is probably the most cited framework for strategic alignment [1;55].
SAM is used as basis for this paper; it introduces two perspectives, namely strategic fit and functional integration. Strategic fit concentrates on alignment between the organization’s external and internal domain while functional integration focuses on alignment between IT and different business functions [3]. This implies that the development of strategic IS requires different stakeholders’ involvement.

The ability of IT to offer strategic advantage is generally not understood [7]. In particularly this has turned out to be quite problematic with enterprise resource planning (ERP) systems where several famous failures have been reported, for example US Air Force\(^1\), Hewlett Packard and Hershey\(^2\). Despite the fact that many challenges related to enterprise systems (ES) projects were already been noted over ten years ago, system implementers still struggle with those same problems [8]. Common conception is that many ES projects fail to meet the objectives.

The multitude of stakeholders involved in ES projects has been identified [9;10;11]. Still, there are surprisingly few papers that actually focus on ERP development ecosystems, i.e. on the organizational stakeholder networks which construct the ERP system. Especially knowledge management and communication between these actors or stakeholders have remained a rarely studied issue [11;12;13]. According to Addo-Tenkorang and Helo [14] most of the ES research is limited only to discussing one or two stakeholder roles. It thus seems that current ES literature does not provide sufficient viewpoints to understand or conduct all kinds of changes needed in the alignment activity [8].

ES implementations are usually accompanied with changes in business processes [23]. The need for more holistic view of the change is also noted in business process re-engineering (BPR) literature [15;16]. BPR is often used to understand and cope with organizational transformation [17]. It focuses on cross-functional processes [18] with various stakeholders. The earlier stated problem of not seeing IT as strategic advantage is taken into account in BPR by considering IT not only being a support function but also being an enabler for new business opportunities and possibilities [19].

Taking the abovementioned deficiencies into account sets the objectives for this paper: we want to construct a framework for understanding ERP development ecosystem and its dynamics thoroughly. The framework would provide a holistic view to both IT and business viewpoints by merging ERP and BPR literature together. This would highlight the IT-business alignment issues (c.f. [3]) that have been identified challenging. Similarly, by mapping out the ERP ecosystem, the existence of different stakeholders will be made evident. Our research questions are: How has IS literature taken ERP development ecosystems into account? What kinds of stakeholders will different perspectives ES and BPR bring to ERP development ecosystem?

Instead of a common strategic perspective, we approach the topic pragmatically, from the micro and macro levels [20]. Few well-known articles were chosen as a basis of the paper. For business-IT alignment, and for the whole paper, Henderson and

\(^1\)http://www.cio.com/article/721628/Air_Force_scraps_massive_ERP_project_after_racking_up_1_billion_in_costs

\(^2\)http://www.cio.com/article/486284/10_Famous_ERP_Disasters_Dustups_and_Disappointments
Venkatraman [3] was selected as a cornerstone. For ES perspective the starting point was Davenport [26]. For BPR perspective both Hammer [18] and Davenport and Short [19] were chosen. The literature was used to create the frameworks in a non-systematic way. Additional literature was selected with forward and backward searches [60]. Google scholar was used to go forward by tracking down following citation from initial and later found articles. References of the selected articles were looked through in order to go backward. Also while searching the selected literature few articles suggested by the search engine were included. Search for relevant stakeholders was ended when no new occurrences were found.

Contributions are interesting for both IS professionals and academics. In practice the framework serves as a tool for decision makers in project planning and for project leaders in management of the project. For academics future research issues are pointed out.

The structure of the paper is as follows. First the connections between the concepts are justified by pointing out common principles and positioning them in relation to each other. Then an initial framework for ERP development ecosystem is outlined. After that the stakeholders from both chosen perspectives are identified. In discussion the perspectives are combined and viewed from strategic alignment point of view. Also future implications are discussed.

2 ES and BPR relationship

ES and BPR are not complimentary even though usually they are said to support each other, and their simultaneous use is considered to lead to better results [21;22]. ES and BPR both focus on processes instead of single functions. According to Robey et al. [23] business processes have to be changed regardless of chosen approach to implement ERP system. Same is pointed out by Huq et al. [24] with a notion that ERP system implementers need to redesign existing processes to properly fit the software. This leads to a claim that ERP implementation can be seen as an organization-wide BPR project. Still, the ES implementation project does not explicitly reengineer the processes, but drives the organization to do that [24].

The dilemma with ES and BPR is their balance in customization. For example the best ERP solutions only cover a maximum of 80% of the workflows of an organization [22]. ERP should thus be customized entirely, which, however, leads to much higher acquisition and maintenance costs, and eventually more complicated upgrades and services [25]. This is mainly caused by the contemporary trend towards ERPs as package software instead of tailored “build from the scratch”-system [13]. Consequently it is usually financially more favorable to change the business processes to comply with the ERP even though the danger for losing the competitive advantages is evident [26]. This is concretized in the cases were the competitive advantage origins from highly specified processes, for example, unique customer service. In case of package ERP, the processes are standardized towards the software vendor’s view of the best business processes [22;26].

ES, BPR and strategic alignment are all interconnected. Business-IT alignment can be seen as a higher, strategic initiative or catalyst which seeks a change in order to
achieve competitive advantage or leverage organizational competence. BPR is considered as a tool to make that change happen while ES is a tool to implement the change i.e. ES could be used to assist in deployment the redesigned processes into practice. If applying the classic model for organizational change [27], where change is happens through unfreezing-change-freezing phases, BPR could be used in unfreezing phase and ES in change phase [28]. The preferred solution is to apply BPR prior to ERP although it has been argued that BPR can also be useful after the implementation [21;28;29]. In relation to SAM, BPR would mostly cover the strategic fit in business domain and the functional integration on internal level. ES again would cover the strategic fit within IT domain and also the functional integration on internal level. This further urges the need to consider both viewpoints.

3 Initial framework

IS are often developed in cooperation between a number of parties, especially when the technology is integrated in organizational setting [30]. The more strategic the information system is, the wider range of stakeholders is involved in decision making process. Stakeholders, i.e. any individual, group or organization that can affect or is affected by the ES [30], also have indirect and complicated interrelationships. This means that by focusing only on their direct connections, the ecosystem cannot be completely interpreted. Nevertheless, all level actors who can influence the ES development should be regarded as stakeholders.

Markus and Robey [20] argue that studying the relationship between information technology and organizational change necessitates the identification of the level of analysis, and different entities. Roughly, individual, group, organization, and society levels can be disentangled. Also the distinction between micro and macro level should be done because they usually rely on different causal structures.

These issues; IT and business, micro and macro, and vendor and customer, sets the basis for our initial framework. The distinction between micro and macro levels is used to identify which organizational level is concerned when addressing different stakeholders. The trend of choosing pre-packaged ERP systems imply that ERP development network consist of at least a vendor and the customer organization [26;31;32]. Altogether, these issues suggest that the ERP development ecosystem framework can be described as a cube, illustrated in Figure 1 below.
4 Enterprise System perspective

Since ES is both strategic choice and enterprise-wide system, it usually deals with multiple stakeholders. Davenport’s [26] simplified ES description includes the business functions and different stakeholders on a very general level. The actors are managers and stakeholders, suppliers, customers, and employees. Stakeholders refer to shareholders and other similar actors. Sathish et al. [13] extend this by adding vendors as stakeholders because of the trend of choosing pre-packaged ES.

Dittrich’s et al. [11] study on ERP customization ecosystem focused on interplay between different internal and external stakeholders. The stakeholders were ERP provider, ERP implementation consultancy and implementation site. This indicates that the axis of organizational entities should be extended to include consultancy as separate entity [see e.g. 33]. Dittrich et al. [11] also suggest that external organizations should be further dissected. The vendor organization has both framework and application developers. Framework developers focus on the vendor’s internal issues while application developers are in contact with consultancy. In long-term cooperation especially, it is possible for the developers work directly with the customers. Consultancy entity is further divided into customization and organizational implementation function where the former communicates with vendor and the latter with the implementation site, more precisely local designers. Local designers communicate within the customer organization and its actual end-users [see also 9]. Parts of source code modification can be done as in-house software unit [31]. This further strengthens the local designers’ role. In technical sense, the integration with other organizational IS indicates that there is a need for expertise in certain technology areas. Thus, in addition to permanent IT staff, also contract IT staff could be used to tackle this issue [9]. End-users have much bigger role in ERP projects than in traditional systems development [33].
Sarker et al. [32] introduce yet another addition to external stakeholders by making a distinction between global ERP provider and their local partners actually delivering the system to the customer. Yet this view is not highly relevant since usually the local partner and ERP implementation consultancy may be the same actor. In this case, however, the notion of global provider actually expands to the vendor entity. In packaged software industry, the growing number of organizations forms alliances or partnerships in order to increase the value co-creation [32]. This indicates that also the vendors’ business management should be included as stakeholder.

There are also different stakeholders within the implementation organization [26]. Rather than just naming them simply as employees and managers, different functions and roles need to be acknowledged [c.f. 34]. For example, it is common for ES projects to have an executive steering team or a steering committee being responsible for the overall project, and reporting directly to the top management. Also project champion could be identified [9]. Project champion is usually from executive level and is in charge of ensuring the adequate resources. In most cases, a specific project team is appointed. Its members are usually selected from different functions. Also a specific project leader can appointed [9]. In ES projects, the most important departments are different business units and IT department. Business unit can further be divided into managers and end-users as well as IT department into managers and technical staff members [9]. Elbanna [31] adds complexity of internal stakeholders by stating the problems related to multiple projects and their possibly contradicting goals and competition for organizational resources [c.f. 35].

Since the scope of ES system extend over the organization’s boundaries [26;21] it is obvious that both business customers and suppliers are stakeholders in development ecosystem [9]. For example, if ES involves extranet function the customers and suppliers can have direct connection to the system, making them both relevant stakeholders. Also different authorities or government agencies are stakeholders [9]. For example legislation sets certain rules for accounting and health and security issues [36;30].

To conclude, ES development is not something that happens in a void, it reaches out both in horizontal and vertical direction making it a complicated network of stakeholders. In other words, different stakeholders are not isolated from each other but they are tightly intertwined [13;30]. This is illustrated in Figure 2. Connections between stakeholders are shown only when they are unambiguous. Note that every actor is not depicted in every context; the point is to outline an extreme example.


5 Business process reengineering perspective

BPR is, above all, a business initiative [17]. It receives input from organization’s vision and strategy. BPR aims to fundamental rethinking and radical redesign of processes in order to achieve improvements in the organization’s performance [18; 19]. The underlying focus on business processes instead of single function, product, job or service stresses the need to consider multiple stakeholders inside the organization. The focus on cross-functional process and the role of IT also implies a connection between IT and business domains on operational or, in the light of initial framework, on micro level. Since the focus is on ERP development ecosystem, only the pre-implementation phases of BPR are under scrutiny [see e.g. 18;37].

In BPR, different stakeholders need to be identified. This enhances understanding on the problem’s complexity, and appreciates the views of different people. This emphasizes stakeholder analysis before redesigning the processes [38]. Further, knowledge sharing between the stakeholders in argued to have a positive impact on BPR [39]. This makes communication between internal and external stakeholders as a BPR success factor [40;41;42].

The stakeholders identified in the BPR planning phase include top management, functional executives, IS executives and external consultants [10;43]. Particularly the top management involvement and support, and a strategic view on the whole process are seen critical for BPR success [15;40;41]. This underlines the role of CIO and his/her office as an essential reengineering actor [38;44]. BPR literature also proposes an executive steering team or a steering committee to be used in projects [24;43;45]. It usually consists of the abovementioned executives and consultants, reengineering team member and additionally HR representation [38]. The steering committee’s position is between top management and business and IT units. In some cases, the project manager or BPR leader is an alternative actor as a single contact point between the executive level and individual business unit [15;25]. Another significant BPR role is the business process owner who is responsible for the overall process. This argues from his/her inclusion in either reengineering team or steering committee.
Using outside consultants in BPR especially in planning phase is suggested [46]. Yet all decisions must be made within the organization [47]. Ranganathan and Dhalival [43] observe that the consultant’s role also vary, ranging from vendors as external consultants to strategic management consultants and IT management consultants. Wastell et al. [38] added another type of consultants, a specific BPR consultant which would be a part of both steering group and reengineering team. These suggest that the consultant organization should be included in the initial framework, and that domain should be further divided into sub-actors.

BPR definitions also extend beyond the organizational boundaries by including suppliers and customers, and redesigning the business networks [21;22;48]. Especially customer focus has been reinforced [see e.g. 15;42]. As benchmarking is often considered as a built-in part of the BPR project [42;46], it is often done in cooperation with software vendors, alliance partners or competitors. They all have an effect on the BPR project. Hence business partners and competitors could have a role in the network. Similarly trade unions and government organs are stakeholders particularly in public sector [10]. Yet their role is seen mainly as guideline providers and regulation setters, and not actually participating. Still, according to our previous definition, they should be viewed as stakeholders. This is emphasized with trade unions whose roles are significant because usually BPR includes downsizing or restructuring [15;49].

BPR efforts need be initiated top-down in order to gain adequate economic and political support [39]. Still all organizational levels should be included [49]. This points out that the network within the organization should be included.

BPR projects often presume a multi-discipline team [17;37;45]. This team may be composed of technicians, managers or consultants, all having knowledge and expertise of different areas [50]. The communication between reengineering team and steering committee and within the reengineering team is considered important [45]. Alternative BPR project organization compromises a functional team, a technical team and a management team. In addition, a system management group acts as a buffer between the user community and the vendor technical support [24].

BPR project stakeholders include many different functional business units, such as accounting, manufacturing and logistics [18;42;51]. Usually the business unit’s manager is included in the reengineering team. Similarly Human resources (HR) should be represented in the planning phase, as a member of the reengineering team [38]. Although HR could be seen as one of the business units, it is vital for success and differs greatly from other business units that it should be considered as a separate actor in the development network. This viewpoint expands the initial framework by adding it some depth. Yet it does not bring in any new horizontal actors, since no distinction between different business units can be made at this point. Nevertheless, this makes the network structure more complex.

User involvement in BPR planning phase has been emphasized. Davenport and Stoddard [17] suggest that operational level employees, the ones actually doing the redesigned work, could design the more detailed process activities and flows. This stresses the need for vertical cooperation so that individuals at operational level should also be included in the reengineering team as practice representatives [38]. Altogether, one of BPR main goals is to increase the empowerment of the employees.
[18;41] implying intensive user involvement. Still, very few studies have reported views of the organization’s employees on BPR [45;52].

The main causes for BPR project failures is said to be the attempts to change too many processes at the same time, or the confusion of BPR with other improvement programs [17;53;54]. Consequently the relationship between BPR project and other improvement initiatives, with shared resources or conflicting goals, need to be considered at least as indirect stakeholders.

To summarize this wide range of BPR stakeholders equips us with broader understanding about this strategic initiative and its focus is on cross-functional processes. The expanded framework from business perspective is shown in Figure 3 below.

![Fig. 3. Stakeholders from BPR perspective](image)

6 Discussion

ES and BPR perspectives together create a more accurate framework. It is illustrated in Figure 4. Some of the stakeholders are common to both ES and BPR perspectives, and are combined to clarify the framework. Although the same stakeholders appear from different perspectives, this kind of common view adds some complexity to the relationships between the stakeholders. Consequently every connection is not illustrated in the framework and some stakeholders play multiple roles. For example a business unit manager is usually a member of reengineering and IT project team. This makes the network even more complicated and stresses the need for a holistic view.
Inspection of the framework points out few interesting issues. First, the sheer number of actors and levels in the ecosystem highlights the need for control and management since the possibility of errors and misunderstandings increases exponentially. In same sense, the framework indicates that there are multiple communities of practice in the ecosystem. This implies that different methods are needed for communication and seeking of mutual understanding. Second, the framework asks for cooperation between micro and macro levels of the implementation organization yet it should be done also within other entities. Since most of the entities are interconnected certain ripple effects might cause problems. For example if the vendor organization’s application developer’s conception of the whole is not in line with the business consultant’s conception the overall alignment in the ecosystem suffers i.e. the gap between micro and macro levels drifts also into other organizations. Finally, business partners and other entities are loosely presented in the framework even though their impact on the overall has been stated earlier. For example supply chain partners or customers might be a part of the development project and their needs should then be communicated all the way to the vendor.

Combined framework illustrates how many of the same organizational players are involved in both IT and business development projects. In other words, the framework clarifies that either in case of ES or BPR project stakeholders and projects are interconnected and cannot function in a void. According to Elbanna [31], “the perception of an IS project as a network provides a dynamic, flatter view of IS project innovation and its management structure”. This further stresses the notion that multiple project issues, for example struggle over power and resources, should be taken into account. In practice the framework could be used for detecting other entities and potential rivals and collaborators [31]. Additionally it could be used to identify boundaries between different communities of practice.

The underlying idea behind the paper is business-IT alignment. Although it is not explicitly articulated, strategic alignment consists mainly the same set of actors as ERP development ecosystem. Especially in a typical line organization the set of stakeholders largely overlap with SAM stakeholders. It seems that functional integration on internal, micro level is not profoundly explored in the alignment research, since it mostly focuses on strategy level [7]. Alignment should ideally reach tactical and operational levels, including individuals there [1;6;56]. For example, Soh et al. [33] notice that the industry best practice reference models are on too high level
for the implementation organization to effectively assess the ERP system’s effect on processes. Our framework thus allows us to analyze the micro level relationships between the stakeholders.

On strategic fit perspective, SAM requires coordination between external and internal domains. This implies the need for cooperation between operational function such as IT department, strategic level such as IT management, and external stakeholders such as technology vendors. On micro-level this indicates that there are various actors involved in decision making as outlined in our framework. The external alignment should also extend the organization’s reach and include crucial partner organizations such as customers and suppliers [57;58]. Often IT strategy modifications follow changes in the customer or vendor requirements [56].

Our framework adds depth to SAM by explicitly describing the potential individuals and groups involved in overall alignment process. This could be further developed by mapping the identified stakeholders into SAM. Yet, it should be noted that alignment is a continuous process which evolves over time. This makes the creation of exhaustive framework challenging.

Social alignment is linked to people and individual attributes, such as cognition [7;62], which is where our framework could be valuable. Research on social dimension of alignment usually focuses on relationship between business and IT executives e.g. CEO and CIO [6:62]. Very few studies [c.f. 61] have taken communication between business and IT people on all organization levels into consideration [62]. Above issues derived from our framework strengthen the need to study social alignment, not only on executive level but on other organizational levels too. Kashanchi and Toland [61] define that “the social dimension of alignment focuses on people within an organization”. Our framework thus extends that definition by pointing out the relevancy of external stakeholders. Thus, not only the mutual understanding between business and IT on all organizational levels needs to be noticed but also external entities and intra-organizational stakeholders should be taken into consideration.

Analyzing the stakeholders in ES or other inter-organizational IS development opens up possibilities to highlight issues that other, more narrow, approaches often neglect [30]. For example, our framework could be used to structure the complex ERP development ecosystem. The framework could also be a starting point for a systematic literature review. Literature review could point out gaps by exploring literature on identified relationships. Since the perspectives only discuss certain part of the framework, we underline the need to consider all of them together, at the same time.

The framework can be used together with many different theoretical approaches to help the composition of initial understanding of the situation. For example stakeholder theory could be further used to evaluate whether some stakeholders require special attention [13]. Learning Network Theory (LNT) could be utilized to explore roles of stakeholders and their interaction in creation of ES/project knowledge base [59].

Most BPR initiatives are considered as sociotechnical phenomenon with significant political component. This explains why relationships between different actors should be taken into account. Sidorova and Sarker [10] suggest that Actor-Network theory (ANT) may provide a tool for richer understanding of complexities involved in BPR
projects. Since the need for a holistic view, the ANT could also be utilized in further investigation of the proposed framework. We contribute that kind of studied by explicitly articulating the stakeholders and their potential roles in the ERP ecosystem.

Also vendor’s perspective in ERP projects is little studied [36]. For the development of new software or IT capabilities organizations engage in strategic alliances and joint ventures with the vendor [3]. It should be noted that in such situation vendors still usually have different interests than the implementation organization and possibly own goals and targets [10;30;36]. This might be the case especially when vendors are developing their own product at the same time. Our framework allows taking vendor or consultancy organization as a starting point.

7 Conclusions

Main contribution of this paper to research is to provide a framework which combines technology and business views of stakeholders in ERP development ecosystem. It offers a better understanding of the examined concepts and their relationship. Also the need for future research to extend the social dimension of alignment is indicated. In empirical research our framework could be utilized in pinpointing different problems and gatekeepers in ERP development ecosystem. The role of business partners could be studied further since they have an impact on IT strategy and from that further to ES and BPR projects [55].

For IS practice our framework, above all, highlights the multitude of stakeholders and organizations involved in ERP development networks providing more holistic view. As a practical implication, both implementing organization and vendor should critically assess own goals and objectives and compare them against each other to see possible conflicts. The importance of communication within and inter-organization has been stressed. Also the issues regarding multiple project environments should be taken into account in development.

Our study has its limitations. For example, the framework is based on an idea of larger line organization or an organization alike. This means that, for example, smaller project-based or expert organizations are left out. Yet we believe the framework is a valuable starting point also in those situations. Secondly, the literature used in this work was not collected systematically. Neither was the method in any way exhaustive nor did it represent all existent literature. This means that we, by all means, do not claim that the framework is comprehensive. It is rather the first attempt to construct it.

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Asked and Answered: Communication Patterns of Experts on an Online Forum

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Abstract. The notion of network structure for social relations dates back half a century. Nowadays people form social networks offline as well as online. At an online community people are connected through information exchange of sorts. Interest groups form often forums to aid each other and discuss things. Programmers are no exception and a question and answer site called Stack Overflow has been up and running since 2008. Our focus is to find patterns of how people interact on this online community and see if we can find expert users. We find 4 different ways to categorize experts, which result in different rankings. We also investigate how expertise is divided among topics, and find some overlap with the global ranking.

Key words: social network, online community, social network analysis, help seeking, programming, communication patterns, expert finding

1 Introduction

People use Internet technologies to communicate with each other. When enough people share a common interest sometimes online communities are formed. An online community can be regarded as a social network. Boyd and Ellison [3] define a social network site as a web-based service that allow people to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users, and (3) view their list of connection. To study these online communities, researchers apply social network analysis [9], often supported by visualizations to illustrate the findings [7]. Social networks analysis focuses on discovering patterns of relationships between people (actors), who are part of the social network. Connections between actors are called ties. This approach also focuses on how information flows between actors (e.g., what kind of information, between whom, to what extent, etc.). This is done to identify informal networks and quantify through statistical analysis the results. Robins [11] suggests that a social network can be represented and visualized as a graph.

Online communities have emerged as one of the most important places for people to seek advice or help [13]. Users of these social network sites usually do not know each other and often are only identified by alias. Still they
are willing to interact with each other for various reasons, such as altruism, reputation privileges, expected reciprocity and direct learning benefits according to Kollock [10]. Common interests are for example based on health, food, sport, programming etc. One example of an online community is Stack Overflow (http://www.stackoverflow.com) — it is a forum where (software) developers from different backgrounds can exchange information in the form of questions and answers. Users of forums have different levels of expertise, and this can affect the quality of their answers. For example, an expert user should be more likely to provide a correct answer. However, since users do not know each other, it can be difficult to determine who is an expert. In this paper we investigate if an analysis of communication patterns can be used to determine expertise. We discuss and investigate different possible patterns and compare which users are considered experts by these patterns. We acknowledge that users can be experts in various fields, and compare how the different patterns rank users for all topics as well as for selected topics. All analyses are performed on a data set from Stack Overflow.

2 A study of the Stack Overflow structure

In order to understand how developers behave and what they talk about on online forums, we need data to study. We rely on a data set, from Bacchelli [1], which contains all the activity on Stack Overflow between 2008-07-31 and 2012-07-31. The data set contains approximately 1.3 million users, 3.5 million questions, 7 million answers, and 13 million comments. Each of the questions are tagged with one or more of approximately 30,000 topics.

2.1 Users and Usage

There is a significant difference between users; if we only consider active users, about 47% have only asked questions and 25% have only answered questions. The bowtie structure [5] is often used to describe complex network structures. It consists of four distinct parts: In, Out, Core, and Tendrils and Tubes. Core forms the strongly connected center of the network structure where every node is somehow connected. In and Out links only to and from the core, respectively. Tendrils and Tubes consists of nodes that is not part of the Core, but links to or from the In or Out. If we use the bowtie structure to describe the forums Core would be the users involved in active discussion, In the users that have their questions answered by the Core, and Out the users that answer questions asked by the Core. The Tendrils and Tubes are users that do not interact with the Core.

The bowtie structure of the world wide web consists of four approximately equal parts, while Stack overflow has a much larger In than Core and Out, respectively (c.f. Figure 1). Zhang et al. [13] report similar results in their study of the Java Forum network and suggest that a smaller Core part can be interpreted
as that a forum is not a community where people discuss and help each other, but rather a public place to get questions answered by volunteers.

If we consider user activity based on how many questions they ask and/or answer, it also varies a lot. A majority of the users have never answered a question, and only 15% and 25% have answered or asked five or more questions. However, there is a group of users that have asked and/or answered more than a thousand questions. The network formed by questions and answers is a scale-free network [2] (the degree distribution follows a power law [6]), i.e., there exists preference — questions and answers are not asked or answered on random.

There is no bias with respect to asked/answer ratio when users decide which questions to answer. Users with a high degree of answered questions answer questions from users with no to many answered questions. This may seem contradictory to a network with preference, but this is not the case. It simply follows from the fact that most users ask and answer few questions and a majority of the questions and answers are from relatively few users.

A user that asked a question can decide which answer was the best or most correct by accepting the answer. If we only consider questions and accepted answers, we find a bowtie structure that is similar to the previous one (c.f. Figure 1). Since there is at most one accepted answer per question, the number of users that have only asked questions has increased, while the users that have only answered questions has decreased. The Core discussion and Tendrils and Tubes are more or less unchanged. The network formed by questions and accepted answers is a scale-free network as well.

There also seems to be no bias with respect to the number of answered when users decide which answer to accept. If we consider the accepted/answer ratio, we find a positive skew: values between 0.0 and 0.5 are more common than values between 0.5 and 1.0. It is interesting to note that there exist users with more than 500 answers and a accepted/answer ratio above 0.8.

Users can vote on posts, for example voting it up or down, and this results in a score per post. This score is an integer, which ranges from -132 to 4432 in
the data set. If we consider the total score and number of posts per users, we find a linear relationship between the two. There is nothing that suggests that a user with a higher amount of posts would have a higher per-post score, or the opposite.

2.2 Tags and topics

Each question can be tagged with up to 5 topics. It is up to the user asking the question to either pick among the existing or introduce new topics. The topics range from generic ones, such as database or algorithm to quite specific, such as mysql-error-1067 or jquery-1.7.

The tags and topics are not structured like a bowtie, but rather like a Jellyfish [12]. There is a complete subgraph that forms the center of the topic network, and topics that are not part of the central core form rings that link to either the central core or a ring. Given the size of the topics network (more than 30,000 nodes and 1.75 million edges), it is computationally expensive to determine the size of the complete subgraph and the rings.

There are no obvious patterns in the topic graph. Given the large amount of edges, many topics are connected to 25-50% of the total topics. We applied a community finding algorithm (Edge-betweenness [8]) and could identify 4 distinct topic groups. These are discussed during the experiment in Section 3.3.

If we consider the topics that are connected to the most other topics, we for example find Java, c# and Android. If we instead consider patterns over time, i.e., the topics that receive the most new questions and answers every month, we also find Java, c# and Android.

3 Finding Experts

Given the large amount of available data from Stack Overflow, can we find experts by looking at communication patterns? It is not clear which communication patterns we expect an expert to have, so we begin by discussing various such patterns and we then search for these patterns in the data to rank users. We then compare these rankings to see if different patterns produce similar rankings, which can be interpreted as an agreement.

3.1 Defining an Expert

The large amount of data makes it impractical to define an expert based on the content of the posts, so we rely on the network structure and specific attributes, such as up-votes or accepted answers. With these constraints, a simple definition of an expert could be the number of questions or users the person has answered. The higher this number, the more of an expert the user is.

The number of answers can be an imprecise measure, since we do not know how relevant the answers are. There is a moderation system on Stack Overflow,
where posts can be marked as spam or irrelevant, and since we filter any such posts, we assume that all answers are relevant. We can also apply some of the post attributes to help improve our measure of how relevant an answer is, for example by only considering accepted answers or answers with a high score.

Accepted answers can be misleading, since there can only be one accepted answer per question, so if two or more users post answers, only one of these will be accepted. We cannot assume that the best answer is always the accepted one; it could simply be that the first answer that is good enough is accepted. High total scores can also be misleading, since the total score will grow with the number of posts, so a user with a large amount of posts where each has a low score, will still have a high total score. We can apply the average score, or the ratio of accepted compared to answered. However, this again can be misleading, depending on how we define an expert. Is it better to have many posts, even if few of them have high scores or are accepted, than only have a few posts but with high scores or accepted?

To summarize, we consider the following as possible attributes of an expert:

– A large amount of answers
– A large amount of accepted answers
– A high total score
– A high average score
– A high ratio of accepted against answered

When we discuss different attributes above, we do not take questions posted into account or relations to other experts. Is a person that posts equally many questions and answers still an expert, or should there be a larger amount of answers? Is a person that answers questions of other experts more of an expert? We can add the following attributes to the list.

– A majority of answers
– Should answer other experts

3.2 Searching for Experts

Based on the attributes defined in the previous section, we can not define a set of actual measures of an expert and compare these. For each measure we find the top 50 experts. These sets of experts are compared among the different measures, in order to find how well they correlate. Note that there is no actual list of expertness, so we define correlation as a measure of correctness; the more methods that correlate, the more correct the results are.

We define the following analyses on the network:

1. Extract the top 50 users based on how many other users they have replied to.
2. Extract the top 50 users based on how many answers they have written in total.
3. Extract the top 50 users based on accepted answers to users.
Table 1. The results of the 10 analyses compared. The first figure shows how similar to sequences are by computing dividing the number of matches with the total number of elements (from 0.0 to 1.0) and the second number shows the number of elements that were in both sequences (from 0 to 50). Note that the table is mirrored across the middle.

<table>
<thead>
<tr>
<th>Analysis</th>
<th>Match Similarity</th>
<th>Number of Matches</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.50</td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>0.48 (49)</td>
<td>48</td>
</tr>
<tr>
<td>3</td>
<td>0.26 (38)</td>
<td>26</td>
</tr>
<tr>
<td>4</td>
<td>0.16 (35)</td>
<td>16</td>
</tr>
<tr>
<td>5</td>
<td>0.0 (0)</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>0.50</td>
<td>50</td>
</tr>
<tr>
<td>7</td>
<td>0.50</td>
<td>50</td>
</tr>
<tr>
<td>8</td>
<td>0.16 (35)</td>
<td>16</td>
</tr>
<tr>
<td>9</td>
<td>0.0 (0)</td>
<td>0</td>
</tr>
</tbody>
</table>

4. Extract the top 50 users based on accepted answers they have written in total.
5. Extract the top 50 users based on total score.
6. Extract the top 50 users based on average score.
7. Extract the top 50 users based on accepted/answered ratio.
8. Extract the top 50 users based on Z-scores that normalize the ask/answer ratio.
9. Extract the top 50 users based on the total answers the persons they answer have posted.

Note that analysis 8 could be extended to cover all the other attributes as well, and for different levels of recursion. To approximate the second case we use the page rank algorithm [4].

To evaluate how similar two sequences are, we use two different measurements. First, we determine how many elements the two have in common. This is calculated using set intersection. Second, we compute the similarity by measuring how often the two sequences agree by calculating the number of agreements multiplied by 2 and divided by the total length of both sequences. Table 1 shows the results of these computations.

We find that analysis 1-5 and 9 often result in similar results. Depending on which pairs we compare, the results vary, but these often include approximately 75% or more of the same experts, in varying positions. Analyses 1 and 2 agree on 47 out of 50 users and are similar to approximately 38%. The latter may sound low, but in many cases, the two sequences only disagree on specific order. For example, what one analysis considers to be the fourth expert might be considered the fifth expert by the other, and hence, there is no match. So, 38% can be considered a high similarity, combined with the 94% match of total users. Analyses 3 and 4 result in the most similar sequences (44%), with 90% match between total users.

Analyses 6, 7, and 8 differ not only from 1-5 and 9, but also among themselves. These are not similar (0%) with no users in common. For analyses 6 and 7, this is due to users that have answered few questions but still have accepted answers or high scores. Analysis 8 is also affected by the actual number of posts; a user
that has posted some answers and no questions will score higher than a user that has posted many answers and some questions (since no questions is further from the equal balance assumed by the Z-score).

There is little to no change if we remove extreme values from analyses 6 and 7, such as users with 1 post with a very high score or users that have answered 1 question and that answer was accepted. The top 50 in analysis 1 have an average score of approximately 5, while the top 50 average scores are all above 100. We need to remove users with less than 1,000 posts to get average scores below 10 in top 50. Similarly, there exist a number of users with a single accepted but few answers in total, so the ratio in the top 50 is again quite high compared to the ratio of the frequent answerers. However, there are also a number of extreme cases, as discussed in Section 2.1.

Analysis 10 applied an unmodified page rank algorithm to the network with users that answered users. The result of this algorithm should be somewhat similar to analysis 9, which is a trivial version of the algorithm. The result of the page rank is similar to analyses 1-5 and 9.

### 3.3 Topics and Experts

If we assume that we can identify experts using one or more of the approaches defined in the previous section, we can investigate whether there exist different experts for different topics. As discussed in Section 2.2, each question is tagged with 1 to 5 distinct topics. Since there are more than 30,000 topics, and many of these are highly related, we attempt to identify experts in selected topics and groupings of topics. We use the following groupings and selections:

1. The top 5 topics with respect to number of posts per month
2. The top 5 topics with respect to how many topics they have co-occurred with
3. 4 groups of topics found by a community finding algorithm that approximately covers:
   a) Microsoft Technologies (e.g., asp.net, ado.net, c#)
   b) Mobile Development (e.g., iOS, Android)
   c) Web Development (e.g., Flash, Javascript, CSS)
   d) Systems Development (e.g, JVM, compiler, jUnit)

The top 5 topics per month, based on the full data set are: Android, Java, Javascript, c#, and PHP (in no particular order), and the top 5 topics with respect to co-occurrence are: c#, Java, PHP, Javascript, and jQuery. Given the large overlap, we include 4 additional topics based on rank: iPhone, .net, c++, and asp.net.

We find that there are some experts that have expertise in several fields. If we compare the 4 groups of topics, we find that Microsoft Technologies and Mobile Development are similar to 10% and 14 users are among the top 50 in both. There is also some overlap between Microsoft Technologies and Web Development, and Mobile Development and Web Development, that both share 1 expert among
the top 5, which hold the same rank. The topic groups overlap with some of the popular topics as well. For example, it is no surprise that there is some overlap between Microsoft Technologies and c#, .net, and asp.net. Similarly, we find overlap in expertise between c++, Systems Development, and Java. If we consider iPhone, a topic that has no obvious connections to any of the other topics, we find overlaps with Javascript. However, we find very little overlap between Web Development and web technologies such as Javascript, PHP or jQuery, for example. This could suggest that our method is flawed.

If we compare the experts within each topic and topic group to the global list of experts determined by page rank in the previous sections, we find that Microsoft Technologies, c#, .net, and c++ overlaps to some degree. The largest overlap is with c# where 5 experts are among the top 50 of both, and the sequences are 4% similar (which suggests that there is at least one position that matches). This is not surprising since c# and .net are among the most popular and common topics discussed on the site.

4 Discussion

We introduced 10 different analyses to find experts. Based on experiments on the Stack Overflow data set, we find that 7 of these analyses provide results that are similar to some degree. Given the large amount of data (millions of users and posts), it is not reasonable to expect perfect matches; however, the 7 analyses that are similar often share more than 50% of the users and about 20-30% of the exact positions. This is not surprising, since they all include the number of answers a user has posted or the number of different users a user has answered. Page rank is also based on the number of incoming links.

The remaining 3 analyses are interesting since each of these is completely different from the other 9. We expected these to be different, given that the ratio and average can be misleading for users with few posts or very high scores per post. Similarly, the normalized Z-scores will prefer users that have not asked any questions to users with many answers and a few questions. However, in the case of ratios and averages, it required a significant filtering (ignoring users that posted less than 1,000 answers) to find some similarity between these 2 and the 7 that are similar to each other. This strongly suggests that each of the 3 and either of the 7 provide different ways to rank experts, that is, we have 4 different ways to describe an expert. We can either look at the average amount of up votes, the ratio of accepted answers, how different a user’s communication is from “normal” communication patterns, or the number of total posts.

If we consider experts within different topics, our results are far from conclusive. We can find some overlap in expertise between different topics, as well as some overlap between specific topic and the global expert ranking. If we consider 4 groups of topics that a community finding algorithm identified, we find that some cases display the excepted overlap while others do not. This is most likely a result of our categorization of the topics. This is something that will require further investigation.
We do not have access to a “proper” measure of who is an expert on Stack Overflow. So, there is no way to evaluate which of the 4 types of analyses, if any, provides the best estimate of an expert. There is a reputation system, where helpful actions, such as answering questions or improving the site, increase a user’s reputation. If we rank the users by reputation, we find that this ranking is similar to 1-5, 9 and 10. This is expected, since reputation is based on activities on the forums, so users with a high reputation will most likely have answered more questions, for example.

5 Conclusions and Future Work

In this paper we investigate if communication patterns can determine expertise and if so, what patterns. We rely on a data set that contains 4 years of questions and answers from the Stack Overflow developer forum. We find 4 possible ways to characterize an expert; amount of activity, average score, ratio of accepted answers, or how different the user’s communication is compared to “normal” communication patterns. We find that the four produce different results, but since we have no correct answer, we cannot determine which of these is the best or most correct. We can relate our findings to the reputation system on Stack Overflow, but this system favors activity and thus any characterization that relies on amount of activity will appear most correct.

We also compare experts within different topics to the global list and find that there is some overlap between similar technologies, such as c# and .net, for example. We do find inconclusive and contradictory results when we apply a community finding algorithm and attempt to find experts within groups of topics. Experts on Microsoft technologies overlap with for example c#, but experts on Web Development does not overlap with Javascript and jQuery. This is most likely due to our naive and simple approach to topic grouping, but the issue requires further investigation. We would also like to investigate if there are any topics with a reasonable amount of questions and answers that have very similar or identical groups of experts.

It would be interesting to perform a study of actual experts on Stack Overflow and compare these to our findings. This is made somewhat difficult given that the data set is to a large degree anonymized. However, the data is available on the site, and our algorithms could be adapted to work with the actual site rather than stored data.

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Intrafaces: A Sociomaterial Take on User Interface Design

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Abstract. This paper introduces intrafaces as a sociomaterial take on user interfaces. Intrafaces enables actions where humans and technology are entangled in the moment and are useful when developing experiences. It invites us to add to the traditional path of user interface design and change perspective on how we comprehend the world. The essence of intrafaces helps us understand how experiences emerge, how human and technology mangles to achieve an action. To design experiences one needs to: 1. consider human and technology as one in action, not as separate entities, and 2. focus on what activity these entities, the social and the technology, together accomplish, and 3. use the notion of agential cut to identify elements and relations involved in the experience. If using intrafaces when designing, the innovation span extends from only considering technology/materiality as the owner of user interfaces to thinking materiality and the social as a collective where intrafaces enable and form the experience.

Keywords: Intrafaces, Sociomateriality, User Interfaces, Experiences, Digitization

1 Introduction

Today's increased focus on experiences where digitized artifacts are involved motivate for a new take on user interfaces design. This paper argues that existing ways of conceptualizing and using user interfaces hamper innovation possibilities to amplify the experience. Traditionally when innovating new digital artifacts, much time is spent on how to make them usable, context sensitive and with correct affordances. This is accomplished with the mean of user interfaces of the technology. We want user interfaces to enable efficiency, adapt to current circumstances and communicate action possibilities to the user. Usability is considered a property belonging to the user interface to enable ease of use and efficiency (Shneiderman et al. 2005) and Lavie et al (2010) point out the importance of including information about user and environment in the system for a context sensitive user interface. To achieve usability much focus is put on efficiency, effectiveness and satisfaction of the user. Developers follow certain guidelines to design usability and potential users of the artifact test the user interface in certain ways to test if it is implemented (Norman 2002). Context sensitivity can be accomplished by sensor technology and algorithms that calculate
usage which can thereafter be implemented as a module in a user interface (Schiaffino et al. 2010). For example, different sensors in the car can inform the user of different states of the car, such as fuel consumption. As with usability is affordance also a property of the system according to Hutchby (Hutchby 2001) and should communicate action possibilities for the user (Norman 2002). For example, a physical knob can be graspable (communicates a possible action of being able to grip it) or turnable (communicates a possible action to turn the knob). Previous research emphasizes the importance of implementing usability, context awareness and affordance, in the technology; in the user interface. With this traditional view comes a distinct separation between the technology and the user. This help designers and innovators to dedicate certain qualities to the technology and others to the user. The separation of different entities, i.e. the user (the social) and the technology (the material), facilitate for an ontological view of the world where one isolates the user from the technology she interacts with.

However, this paper argues for a different view when innovating, namely a sociomaterial. In sociomateriality one draws on Niels Bohr philosophy-physics on how the social and the material are entangled and gets meaning and relevance in enactment, in action (Barad 2007). Since many of our inventions today are experiences where the physical product, the technology, only is one component of many within the experience, should the sociomaterial enactment be in focus, neither the technology/material nor the social solely. Even though the nature of what is being designed has changed, from being purely a material product as is, to sociomaterial experiences, the ontological perspective on separate entities is too established with its concepts and language usage (Kaptelinin et al. 2012). This paper argues that this has a hampering effect, limiting new innovations and designs. To overcome this hampering effect this paper suggests that a change of ontological perspective is necessary. This ontological change includes an embracement of sociomateriality where the material, the technology, and the social are equally included and dependent in the enactment, aka the experience. Without one there is no experience, the elements included are one in the experience (Schultze 2012). The objective of this paper is therefor to explain and motivate a sociomaterial complement to user interfaces. It emphasizes the importance of a sociomaterial perspective when innovating and the paper introduce the concept of intrafaces. Inspired by Barad (2007) the definition of intrafaces in this paper is; emerging quasi-objects, distinguishable temporally with the help of an agential cut within an action, enabling intra-actions. This can be contrasted to a user interface which enables interactions between the technology and the user. This contrast emphasizes the difference between intrafaces vs. interface, intra-action vs. interaction, within vs. between.

The MIT invention SixthSense is used to further illustrate the differences between user interface and intrafaces. SixthSense facilitate action with things in our surroundings, such as an airplane ticket or a map, and retrieve or exchange information about the thing. It also allows for showing information on any surface and is a “wearable gestural interface that augments the physical world around us with digital information” (Mistry 2010). It is possible with SixthSense to take pictures just by making a “framing” with the fingers and thereafter watch and arrange the pictures taken on any surface. It can project information onto basically any surface or physical
object in the close vicinity. So, with the concept of user interface, which can be considered as a layer between the technology and the user (Marcus 2002; Nielsen et al. 1993; Shneiderman et al. 2005), it becomes difficult to identify where and when the user interface is in the SixthSense solution. It is everywhere, nowhere, momentarily and all the time depending on action. In other words, it is an emerging quasi-object distinguishable temporally. The only way to identify intrafaces included in the action is to make an agential cut (Barad 2007) in the action. When making this cut one can identify what elements and relations are involved and what intra-actions are taking place within the entanglement at that very moment. This highlights the limitations of the concept of user interface and motivate for the usage of intrafaces. Intrafaces in the SixthSense solution are emerging momentarily within the entanglement of the social and the material, the entanglement is producing it and consuming it simultaneously in action. More importantly, it is likely to have effects on how the enactment is experienced.

The SixthSense solution characterizes the digitization of the world. The digitization of the world enables actions that differ from a non-digitized world (Yoo 2010). Ways to experience by communicating, sharing, connecting and creating are constantly changing. The constant changes require a more flexible and dynamic view where the traditional way of thinking about user interfaces is limiting. The limitations originate from the traditional way of thinking about user interfaces with belonging attributes such as usability, context awareness, and affordance. It is limiting because usability is not a property of a user interface, but rather understood within each action that the human and technology performs (Riemer et al. 2010). Furthermore, context cannot be considered stable and possible to separate from the action. Context is rather relational between the elements involved and arises from activity (Dourish 2004). Also, affordance is not allowable actions specified by the environment, even if it is coupled with certain properties of the human and context. Instead, affordance can be defined as a relational process the human and the world (context, technology and other elements of the world) comes to be mirrored in the action possibilities (Bloomfield et al. 2010).

This paper draws on current HCI literature and presents difficulties with the traditional concepts of usability, context and affordance. With these difficulties identified in the HCI literature in conjunction with a presentation of the emerging literature on sociomateriality (Cecez-Kecmanovic et al. 2010; Leonardi 2011; Orlikowski et al. 2008) the concept of intrafaces is introduced. The paper discusses the importance of a new perspective in a world that is increasingly digitized and where experiences are becoming center stage. The concept is especially important for organizations with institutionalized structures, led by dominant designs in their product innovation, to enable a break from current path and think new.

An explanation of how the concept emerged is presented in the following section and is thereafter followed by a presentation of existing definitions of user interfaces based on current research. The paper continues to explain the concept of intrafaces and ends with a discussion of the concept.
2 Methodological Approach to Generate a New Perspective

This paper draws on a literature review based on Webster and Watson (Webster et al. 2002) to build the basis for generating the intraface perspective. However, the research origins from several years of involvement in research projects focusing on the designing and development of user interfaces. The research projects have focused on product manufacturing firms where the increase, presence and importance of software in their products have effects on how they design their product. Along with the increase of software in the product also came redefinition of product goals. For example, a traditional goal includes a limit of five second, from start to finish, interaction with a certain user interface menu to accomplish a specific task. New goals are more difficult to measure and are expressed in wordings like “the user should experience emotional attractiveness”. Engineers developing the user interfaces not only struggle with the change of material, going from, for example, physical handles to digital displays, they also have difficulties to explain and define what user interfaces are, not only to themselves but also to the rest of the organization. However, the question of “what is a user interface?” is not enough to improve the understanding and further advance the development of experiences, but rather the questions of when and where is the user interface?

A literature review of HCI research focusing on user interface design and belonging concepts was accomplished to improve the understanding of current user interface design research. The literature review was done in three phases. The first phase included a structured search for a better understanding of the concept of user interfaces. It included searching ISI Web of Knowledge focusing on definitions of “user interface” and “user interface design”. The second phase was an effect of the first structured search ending up with literature that was mentioned in the first phase. The last phase emerged out of the ongoing discussion within the IS field about sociomateriality.

The first phase of the literature review started out with three different journals chosen on three different criteria. First, the journal had to be on the top of Journal Citations Reports on ISI Web of Knowledge and second, the journals had to represent different parts of the world and lastly, they all had to have a focus, but not solely, in user interface design. With these three criteria the following journals were used; ACM Transactions on Computer-Human Interaction (TOCHI), International Journal of Human-Computer Studies (IJHCS) and Scandinavian Journal of Information Systems (SJIS). 34 papers from the three journals were relevant and of specific interest to further understand what, when and where a user interface is.

The second phase of the literature review included papers referred to by the papers from the first phase as well as an open search for concepts that came up during the literature review. Three concepts standing out were Usability, Context sensitivity and Affordance and therefor further explored. In the exploration of recent publications discussing user interface design and the three belonging concepts, another ontological view derived, namely sociomateriality. Consequently, the third face focused on getting a better understanding of sociomateriality in relation to user interface design.
With this as background the next section describes the outcome of the literature review.

3 The Separation in User Interface Design – a Review

Depending on how the user interface works, how well the user can interact with the technology through the user interface, the effects of it can be seen all the way up to Wall Street (Shneiderman et al. 2005). Due to this, it has for long been conventional to measure the effectiveness, efficiency and ease-of-use of user interfaces (Nielsen et al. 1993). For example, emphasizing standardization and consistency within the user interface has been two mottos to follow to reach these measures (Shneiderman et al. 2005).

Standardization includes fixed ISO standards that are developed for a certain reason or specific organizational standards that complement existing ISO standards (Bevan 2001). For example, “usable products can be designed by incorporating product features and attributes known to benefit users in particular contexts of use” (Bevan 2001)( p 542). However, complex user interfaces can have an inertial effect on novice users who are overwhelmed by all the options, and it is problematic for expert users who tend to use only a fragment of the system (Findlater et al. 2010). To overcome the complexity dilemma implementation of adaptive user interfaces is done. These interfaces are said to help to improve user interaction with systems by facilitating user performance, minimizing the need for help, easing system use, and avoiding cognitive overload problem (Lavie et al. 2010).

Consistency is assumed to reduce confusion for a user, which leads to faster learning and ease of use, especially between different systems (Nielsen 1989). This has been confirmed by other researcher who argues that consistency can reduce training time up to 300% (Polson et al. 1990; Shneiderman 1987) and Shneiderman (1987) includes “the strive for consistency” as one of the main principles in user interface design. Consistency can be implemented in the user interface by always using the same menu structure or having an icon representing something specific across the system/s. Nielsen argues that “consistency improves the user's productivity by leading to higher throughput and fewer errors because the user can predict what the system will do in any given situation and because the user can rely on a few rules to govern use of the system” (Nielsen 1989) (p. 63).

So, the user interface is often considered as an attribute to the technology; the technology has a user interface which enables users to interact with the technology. This is illustrated by the dotted line surrounding the solid box names technology in figure 1. In addition, the solid connection lines between the technology box and usability, affordance and context sensitivity shows that these properties is a part of the technology.
Fig. 1. Illustration of a traditional view of user interface belonging to the technology with certain properties.

Interactions are between the user and the technology with help of the layer surrounding the technology, the user interface.

Thus, user interfaces can be described as a structure for communication between a user and the computer (Daintith 2009). When developing a user interface, standards and guidelines are used to achieve good and usable representations of reality in the user interface. That is, development of representations of the world is used to make it easy for the user to understand what to do with the system. For example, a digital recycle bin icon on the computer desktop is used to represent the physical recycle bin standing by the desk in the office. Some argue that the closer a user interface is to reality, the better it is representing the reality, the better user interface (Shneiderman et al. 2005).

3.1 User Interface and Context

The concepts of context and user interfaces have a close relationship. To include knowledge and information of when a system will be used and how the surrounding environment works benefit the user (Alarcón 2006). A system that is used in a complex situation, and has information about the context, can assist the user (Reeves et al. 2004). For example, if a user is driving in a complex traffic situation, the system can choose to enable, or disable, presentation of certain information. Research has shown that user interfaces that have context awareness and are adaptive, help users to reduce cognitive load and deal with complexity, minimize the need for help and facilitate easier use of system (Edmonds et al. 1999; Trumbly et al. 1994). However, others point out the difficulties of including context information of when the system is used, such as population that uses the system and in what environment. For example, the algorithm for interface adaptation used for one context where the system always is used in the same way may be efficient, while in another context the usage might vary more and the adaptation algorithm cause inefficiency (Lavie et al. 2010).

Adaptive multimodal interfaces are also focusing on context awareness and are developed to improve users experience and make them satisfied by allowing several different ways of input and output. The focus on multimodal interface has recently received more focus due to attempts to make interaction more natural between the user and computer. Other examples of context sensitive user interfaces are interface agents, which provides personalized assistance by foreseeing when and how a user wants to be assisted (Schiaffino et al. 2010). For example, sometimes a user wants to be interrupted while doing a task, while at other times or in another context the interruption would be inappropriate. User preferences, habits, knowledge, behavioral
patterns, regarding a particular domain for a specific user can be recognized and thereafter used by an interface agent. According to Schiaffino et al. (2010) is this possible by including a degree of certainty in a mathematical model and implement it into the system.

3.2 User Interfaces and Usability

Usability is a very central concept in the HCI academic discipline with dedicated tracks on conferences and special issues of journals focusing on the subject. It is also important outside of the academic world with associations devoted to professionals working with usability and several webpages writing only about usability methods, guidelines, test and evaluations. The U.S government even has a website dedicated to usability (www.usability.gov) and there is an ISO standard, 9241, (Iso 1998) defining what it is and how to measure it.

The concept is rather mature and can be defined as a property that assesses how easy a user interface is to use (Bevan 2001; Goodwin 1987; Hartson et al. 2001; Lavery et al. 1997; Norman 2002). Improving usability is about optimizing efficiency, effectiveness and satisfaction for the user, by the mean of user interface solutions. Many different aspects are included in the usability concept including acceptance, use, and adoption (Bevan 1991; Tractinsky 1997), learnability and relevance (Lecerof et al. 1998), user experience, engagement and emotions in general (Hartmann et al. 2008) social emotions in particular, such as enjoyment, connectedness, cohesion (Lim et al. 2011) to name a few.

Just as context, is usability a notion difficult to understand and grasp, but the two concepts are also highly related. Much research brings up the relation of usability and context where usability is dependent of context of use (Kong et al. 2011). For example, the usability of a navigation system in a car is much dependent on if the car is moving or if it is standing still. Even though all stakeholders want a system with high usability, research shows the difficulty of testing and evaluating usability in the correct context (Ovaska 1991). To overcome this obstacle, tools have been developed to enable usability evaluation and testing in the correct context (Bevan et al. 1994). The context of use, i.e. user goals and needs, tasks to be accomplished, environmental characteristics are different aspects to take into consideration when usability is in focus.

Other research shows how aesthetics have effects on usability measures. Aesthetic user interfaces can be perceived as highly usable just because they are considered beautiful (Tractinsky 1997; Tractinsky et al. 2000) and Hartmann et al. (2008) show that even though an aesthetic user interface has less favorable usability features compared to a less aesthetic user interface with high usability features, the majority chooses the aesthetic one with less usability for future interaction. Consequently, a beautiful user interface can be as efficient and effective as a usable user interface. So, the relation is complex, it is not only “what is beautiful is usable” as Tractinsky et al. (2000) argue. The Hartmann et al. (2008) paper point out that more graphical metaphor-based designs, as they studied, are perceived as having better aesthetics, yet at the same time worse usability, while other papers show that mapping an artifact
to a person’s capabilities provides both for usability and aesthetically rewarding experience (Djajadiningrat et al. 2004).

Obstacles within development processes and usability include resource constraints, attitudes and resistance, lack of understanding of the concept in general and also lack of usability experts (Clegg et al. 1997; Rosenbaum et al. 2000). To overcome this, an immense amount of different techniques, tools and methods have been developed to ease the process of attaining systems with high usability. This includes a technique of how to cope with interactive systems (Navarre et al. 2009), a taxonomy of usability (Alonso-Rios et al. 2009), heuristic evaluation (Nielsen 1992; Nielsen 1994; Nielsen et al. 1990), cognitive walkthroughs (Holzinger 2005), action analysis (Andre et al. 2001; Pinelle et al. 2003) to mention a few. However, even though they all involve end users and context they implicitly address usability as a property to the system, embedded in the user interface.

### 3.3 User interfaces and Affordance

Affordance is a well-known and used concept in user interface design, just like context sensitivity and usability. Affordance, or perceived affordance (Norman 1988), encompasses the properties of a thing that determine how it can be used. For example, the affordance of glass is that it is breakable and “see-thru-able” (transparent) and to increase or decrease the volume of a knob, it can have the affordances of graspable and turnable. Affordances are fundamental properties of material that determine how it can be used and is perceived by the user “suggesting” different interaction possibilities (Norman 2002). A user interface’s affordance can be described as something that is shaped and sized for a certain interaction, such as to afford finger manipulation (Zhai et al. 1996). It is the material as is, which possesses the affordance (Hutchby 2001).

However, it has been pointed out that there are differences between affordance in physical material and affordance on a digital material, such as digital screen (Norman 2002). But real world material affordances are yet often used in user interface design. For example, a digital lid on the trash box icon that can be opened and closed, or an opening on the digital document folder where you can place your digital documents, just like a physical document folder. So, to develop a user interface, one often uses the perceivable affordances from the physical world and implements it in digital format.

To be sure to achieve a certain affordance of a system one needs to consider at least three important aspects when designing, namely ambiguity, uniqueness and dominance (Goonetilleke et al. 2001). If something is designed to allow for multiple interpretations, that is, if it is ambiguous, it results in too many interaction possibilities. For example, an icon representing a face can be perceived differently depending on context. More so, there are icons that can be perceived different in a given context as well (Goonetilleke et al. 2001).

With this in mind the paper now continues with explaining the concept of sociomateriality and intrafaces.
Sociomaterial Intrafaces

Sociomateriality is a concept that embraces the notion of socio-technical entanglement, which includes the underlying assumption of an entanglement of things (the material) and people (the social). It is about questioning and rethinking “the supposed ontological separation among the social and the technological” (Cecez-Kecmanovic et al. 2010). The increased digitalization makes it difficult to look at the world separating it from ourselves, we are in the world, being a part of the world (Schultze 2012). Ontological concepts such as cybernetics (Ashby 1956), performativity (Barad 2003; Pickering 1995) and actor network theory (Callon 1991; Latour 2005), quadruple objects (Harman 2011) all discuss human and non-human objects in entangled networks, social–technological assemblages and entanglements or material-semiotic relationships and dependencies. However, they are all sociomaterial concepts with different nuances, emphasizing on different aspects.

Already in 1990 a first mentioning of the word Intrafaces were suggested and addressed by Forrester and Reason (Forrester et al. 1990). They draw their conclusions based on issues arising from navigational and learning problems in hypertext domains. Yet, they make clear separation between the user, the interest the user has, the tools employed and “the ‘ensemble’ of representations brought to bear” (Forrester et al. 1990) p. 279). However, they make an effort in including sociomaterial perspectives even though it is not explicitly mentioned. They write: “In the everyday world of system design, procedures are devised largely on an ad hoc [in the doing, in the action. Authors interpretation] basis, and the argument here is that unless a more considered theoretical framework is developed – to include user, system, task domain and the learning process itself – little cumulative progress will be made. We must identify more clearly what exactly is involved when a person uses (and learns from) a computer if we are to realize the considerable potential of more recent technological developments such as CD storage devices and hypertext systems” (p. 279). This text addresses many sociomaterial perspectives along with motivations why this is important. They define their ontological perspective as a set of key elements within a dynamic interconnected context. Furthermore, they define intrafaces as: “…a dynamic relationship between the user, an interest, (e.g. problem specification, task solution, browsing activity), and an ensemble of representations (via screen, notepad, user’s memory, and so on) and tools (e.g. software manipulation, pencil, user tactics and techniques)”. The definition of intrafaces used in this paper is emerging quasi-objects, distinguishable temporally with the help of an agential cut within a socio-technical entanglement in action, enabling intra-actions. One of the important distinctions here includes the lack of separation and representationalism in this paper’s definition compared to Forrester and Reason’s. Furthermore, the dynamic relationships emerge within the entanglement and the elements involved in general, not between the social and material.

One reason for focusing on within, is the communicability and agency of material (Yoo et al. 2012). Not only can human beings communicate and have agency on the material, but material can communicate and affect humans and empower actions in certain directions. There are many examples of where actions are empowered due to the agency of the material. For example, many people have experienced the necessity
of moving around to find a good connection when on the phone. As Forrester and
Reason point out “The prevalent and largely mistaken conception is that the interface
is the representational window through which the user (usually human, but not
necessarily so) addresses, manipulates and is informed about the system.” (Forrester et
al. 1990) p. 284). Sociomateriality argues that it is as much the system that addresses,
manipulates and informs the user.

To further explain sociomateriality certain relevant concepts are presented in the text
that follows, namely, intra-actions, agential cuts and quasi-objects and their relations
to agency.

4.1 Intra-actions and Agency

Intra-action is a concept coined by Barad (1996) to emphasize emerged actions within
the entanglements of elements, social and material. This can be contrasted to
interaction where the emphasis is on actions between the different separated elements,
such as a computer and a human. To understand what intra-actions are performed and
what elements are included, observation of the action in the moment, is necessary.
When observing an action, the understanding of what elements in the entanglement
are involved make the observational lens more flexible to include necessary elements
that influence an action aka experience.

This also means that the meaning of an action is either at the technology or the user,
with intra-actions meanings emerge, or co-articulates (Iedema 2007). Both the social
and the material have effects on each other within an entanglement and the intra-
actions within the entanglement have effects that have implications on how the
entanglement develops. This implication can also be described as agency (Pickering
2001). Agency is a dialectic dance of resistance and accommodations between the
different elements within the entanglement (Leonardi 2011; Pickering 1995). The co-
evolvement of agency is an important part of sociomateriality and makes the lens
more open to flexibility and dynamism (Leonardi 2011).

4.2 Agential Cuts and Agency

To separate and understand the different elements within the entanglement an agential
cut can be made in the enactment. This cut enables us to separate and identify the
different elements included in the entanglement in a specific moment (Barad 2007).
Depending on when this agential cut is being made, the separation of the
entanglement will be different. That is, certain elements might have different roles,
different agencies and more importantly, elements are added to, as well withdrawn
from, the entanglement throughout an action.

As mentioned above, within an entanglement are all elements equally influential and
they jointly coproduce agency, that is, it is temporally emergent in practice (Pickering
2011). The entanglement constructs “goals that refer to a presently nonexistent future
states and then seek to bring them about” (Pickering 2011) (p. 18) in “the doing”. So,
agency evolves mutually in the action. For example, not only is the user making
decisions and influencing the computer, but the computer encompasses agency and
takes the user in a certain direction. Consequently, the agency evolves within the entanglement of the computer and the user and only with an agential cut one can identify where the agency is currently strongest among the elements involved. Agency is not a property to a certain entity, but to “the ongoing reconfigurings of the world” (Barad 2007) p141. This is also illustrated in brain-computer interfaces where it is difficult to know who has the agency when, the brain (social) or the computer (material) (Williamson et al. 2009), they are one in action.

4.3 Quasi-objects and Agency

The French philosopher Michel Serres use quasi-objects to describe something that emerges in action, cooperation between material and the social, it creates the collective and its meaning. It is in some way enabling the entanglement. Serre explains quasi-objects referring to the meaning of a ball in action. When the ball is used it creates the meaning of the action (Serres 1980). Consequently, a quasi-object is a transparent mean and can be explained as a connective medium (Bodker 1990). It is neither a subject nor object; it is neither material nor social, it emerges and disappears and it can be considered as multiple and single simultaneously.

To further explain what a quasi-object is, the classic text by Bateson about the blind man with a stick is used. Bateson finishes the text with “Where does the blind man’s self begin? At the tip of the stick? At the handle of the stick? Or at some halfway up the stick? These questions are nonsense, because the stick is a pathway along which differences are transmitted under transformation, so that to draw a delimiting line across this pathway is to cut off a part of the systemic circuit which determines the blind man’s locomotion ” (Bateson 1972) (p. 318). In the Blind man example is the quasi-object equal to information transmission. The information transmission can emerge between the stone and the stick, the hand and the handle of the stick or somewhere on the way up the stick or in the man’s brain. But more importantly, quasi-objects can emerge at several places at the same time. This highlights the quasi-object as an information transmission where the separateness of the social and the material is of little help.

5 Revisiting Context, Usability and Affordance

Now when the concepts of intra-actions, agential cut and quasi-objects are explained it is time to revisit context, usability and affordance and present them from an intraface perspective.

5.1 Context and Intrafaces

It is difficult to understand when context awareness and context sensitivity is something to emphasize in the design process (Lavie et al. 2010). Context is traditionally considered as a form of information, which is delineable and stable and where one separates not only the user and the technology, but also often activity and context (Dourish 2004). However, context is not simply about information, but is a
more complex relational property that exists when a diverse set of elements enacts. It is not delineable where one can define and foresee what counts as a context, but dynamic and features constant re-configurations (Suchman 1987; Suchman 2007). A context is never stable and it is not possible to determine what contextual elements to include from time to time. Context can therefore rather be considered as an occasioned property that is relevant to particular settings, actions and elements involved (Dourish 2004).

Redström (2008) illustrates with the Interactive Pillow (see Redström, 2008 for more detailed information) how context is an occasioned and relational property and how situational doings have little or no use of the traditional concept of context. Context is “actively produced, maintained and enacted in the course of the activity at hand” (Dourish 2004)(p. 22) and therefore only identifiable in the moment of the action. The social and material elements involved are spread out and the quasi-objects emerging within the entanglement have effects on the context that cannot be foreseen. It is a constant re-configuration of the world (Suchman 2006).

5.2 Intrafaces and Usability

Usability can no longer be considered a property to the technology according to (Riemer et al. 2010), or more specifically, to the user interface. Usability only manifests in the sociomaterial use context and should not be conceptualized as something in its own right. One needs to understand the entanglement of the social, which can include use context, social ideas, norms and practices, as well as the technical aspects when talking about usability (Riemer et al. 2010). Usability can exist and not exist at the same time depending on social and material elements and their specific entanglements in the action just like Hartmann et al. (2008) mention in regards to aesthetic user interface solutions. Also, Molich et al. (2004) report on a study where seven labs together identified 310 usability problems in total, but only one single problem was identified by all seven labs. This study also showed that 75% of the problems were identified by one lab.

Consequently, usability is rather something emerging within a specific sociomaterial entanglement. Usability is dependent on how quasi-objects occur within the entanglement and can thereafter be studied, interpreted and possibly measured.

5.3 Intrafaces and Affordance

Gibson (1977), who originally introduced the term affordance, uses it as a way to explain all "action possibilities" existing latent in the environment. This means that there is a relation between the material and the environment. More specifically, action possibilities consist of a relation between the action made and the context. Affordance is a property of an ecology consisting of material, environment and human (or animal) in conjunction (Gibson 1977). For example, a big stone in a garden can be something to sit on for a bird, something to step on to reach a branch for a human, or somewhere to sleep in the sun for a lizard. In other words, the stone can be “sittable”, “climbable” or “sleepable” depending on who is using it and in what context. The Gibsonian definition of affordance is “the allowable actions specified by the environment
coupled with the properties of the organism” (Zhang et al. 2006) (p. 337). Cooper (2001) argues that it is impossible to neglect the incompleteness of objects and bodies; they are always partial. This goes along with Heidegger’s discussion of “things” where he defines a jug not only by its material but by its void inside of it. This void not only shapes the jug but the jug is also shaped by it (Heidegger et al. 1967).

Bodies and objects are defined momentarily through entanglements with other partial objects and non-objects, such as voids, and the affordance of this entanglement can only be understood in action. So, in order to define affordance one must include the action of the sociomaterial entanglement in the occasioned and relational property of context. Affordance emerge in the imbrication of the social and the material (Leonardi 2011). Bloomfield et al. (2010) takes it yet further and say that “It is therefore a process through which the body [the social: authors comment] comes to grant particular affordances to the (made) world [the material: authors comment] and conversely, the world comes to be ‘mirrored’ in the effectivities or action capabilities of the body. Sociality and materiality appear irredeemably entangled with one another” (p. 429).

6 Discussion

Bilandzic et al. (2012) point out the complexity of a world where relations between people and digital technology is changing due to temporal and spatial differences. For example, the constant presence of a person, in time and space, by digital mean and information infrastructures, such as Facebook or mobile phones, is contradicting to the actual physical presence of a person which is limited both in time and space. In a world where the separation of the IRL (In Real Life) identity from the Avatar’s identity in a computer game only can be done by an agential cut, sociomateriality matters (Schultze 2012). The digitalization has effects on how we can and should perceive and apprehend the world and of course consequences when designing experiences. The digitization of artifacts used both consciously and unconsciously (Yoo 2010) blurs the boundaries between the user and the artifact (Yoo et al. 2012) and the distinct separation between the social and the technology can be questioned (Schultze 2012). In addition, with the increased digitalization Yoo (2013) encourage IS scholars to “stretch the boundaries of their intellectual imagination beyond the comfort of IS journals and conferences” with the sociomaterial perspective.

With this start of the discussion section, let us go back to Bateson’s blind man. The blind man with the stick in Bateson’s text will have little improvement of his experience if the only focus is on the handle of the stick, as traditionally done within user interface design. To consider the man-stick entanglement as a whole to understand how experiences can be created, enhances, intensified and improved allows for a more flexible and dynamic approach to design. Again, this becomes even more relevant with the increased digitization with its attributed of generativity and re-programmability (Yoo 2013; Yoo et al. 2010).

Also, it has been recognized that there is little research is done focusing on sociomateriality and user interfaces (Riemer et al. 2010). Although no one picked up
Forrester and Reason’s call for a sociomaterial perspective on user interfaces after it was introduced in the 90’ies, it is now time to move forward and study this further. Especially since the increased presence and importance of digital material have effects on what we do, how we do it, why we do it and if we do it. In other words, it is important to study to further understand how (digital) material is, and should be, involved in experiences (Yoo 2010). However, the separations between the social and material, which is the current norm, limit us to innovate unimpeded. It forces us back into assigning usability to the technology, developing algorithms for context awareness to be implemented in the technology and trying to find representations from the physical world to be embedded in the digital technology to communicate affordance. This results in forgetting about the overall experience.

Furthermore, when using the established concept of user interface in the sociomaterial perspective one drops the focus on the user and emphasizes the action. Not including user in the concept highlights that all elements, social and material, within the entanglement are equally important. Without intrafaces there will be no action and intrafaces don’t belong to the user, nor to the technology, but to the entanglement in action. The intrafaces enable intra-actions within the assemblage which in turn have an effect. This effect is a part of the experience.

Consequently, traditional user interface concepts presented and discussed can obviously have other meanings depending on ontological perspective as seen in Dourish (Dourish 2004), Reimer and Vehring (Riemer et al. 2010) and Bloomfield et al’s (Bloomfield et al. 2010) papers about context, usability and affordance. That is, from a sociomaterial perspective it is argued that contextuality is a relational property that holds between objects or activities and the scope of contextual features is defined dynamically. It is temporary and continuously changing and arises from the activity (Dourish 2004). Sociomaterial usability can consequently only be understood within each of the particular use contexts, which in turn emerges from the enactment of the entanglement (Riemer et al. 2010). With this perspective, one can question usability tests and guidelines of user interfaces. Lastly, affordance is when ‘sociality’ and ‘materiality’ appear irredeemably entangled with one another (Bloomfield et al. 2010). This means that the sociomaterial entanglement with its emerged intrafaces get their purpose and meaning in the action and emerges and evolves in the reconfigurations.

The figures below shows a sociomaterial entanglement in action, the elements are all one in the doing (figure 2). When a cut is made the different elements can be categorized and recognized (figure 3). Furthermore, intrafaces within the entanglement can be identified and further studied to understand its relevance to the action (figure 4).
These figures imply a first set of guidelines to further advance experiential design where digitized artifacts are involved (Yoo 2010). Firstly, when starting to design an experience it is necessary to consider the social and the material as one in action, not as separate entities. Secondly, by performing an agential cut the different elements included can be identified and valued. For example, asking questions like “what elements are more important than others in this experience?” and “can we improve the experience by consciously adding new elements into the entanglement?” Lastly, when all the elements are identified, the next step is to understand emerging relations between the different elements. In other words, recognizing the intrafaces and possibilities to manipulate or provoke new intrafaces to arise or disappear depending on what experience is designed.

Lastly, depending on what ontological view designers have in a developing process, the outcome will be different. Institutionalized processes need to be adjusted to fit to current circumstances where digitization is increasing in amount and importance.

7 Conclusion

This conceptual paper introduces the concept of intrafaces. Intrafaces are quasi-objects that emerge within sociomaterial entanglements enabling information transformation between involved elements that result in some action, which have an effect on the experience. It is of high relevance to change from the traditional view of user interfaces to intrafaces to enable new innovations of experiences where the social and the material are equally important and influential. However, intrafaces does not replace user interfaces, but rather complements it and opens up new ways of thinking about what and how to innovate.

Still, intrafaces is a new concept and needs further study to understand and define its relevance. For one, it would be interesting to see how it can be included in innovation processes in an efficient and valuable way. Furthermore, the guidelines presented in
this paper need to be further developed and tried out in, both from an academia as well as from a practitioner's point of view.

8 References


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A Model of Drifting Processes – the Open Data Policy Implementation Process

Abstract. In this paper we explore the on-going implementation of the Public Sector Information (PSI) directive, which is in line with current trends of opening up data for reuse, innovations and new digital services. Today the time frame for implementation set by the European Commission is passed, but the process of implementing the directive is still on-going, more or less successful. We explore organizational culture as one cause for policy implementation processes drifting away from the policy objectives. Our findings build on research from two projects that focus on creating digital services based on archival material. We conclude that policies must be translated and understood at different levels, and that there must be adaptation between the policy and the organizational culture type, with its related values, behaviors and artifacts for a successful policy implementation regardless whether this happens within, or after, expected time frame. Built on our findings, we provide a model that is our first attempt to illustrate, describe and explain the policy implementation process and how it might drift away from or towards the policy objectives.

Keywords: organizational culture, open innovation, open data, digital services, policy implementation.

1 Introduction

In today’s Europe, there is an emerging trend among private and public organizations to open up their borders and resources with the objective to stimulate organizational and societal growth through innovation [e.g. 1, 2, 3]. Related to that, openness and open data is the most recently used concept in the initiative of transforming the delivery of digital services among public organizations [4]. The ideas of openness are globally spread and public sector organizations are actively working on implementing policies for opening up data. In Europe this happens through the Public Sector Information (PSI) directive that defines a high level framework for how, what and when public sector information should be open for re-use by citizens. Originally the PSI directive set out the general legislative framework at European level in 2003. During the review in 2009, the European Commission (EC) stated that in spite of
progress, there were still barriers to the cross-border use of public sector information [5]. The EC also noted that some of these barriers could be tackled within the existing legislation, while others cannot. The PSI directive is to be updated to further open up the market for services based on public sector information [5-8]. This is to be done by including new bodies (the cultural heritage sector, which is archives, libraries and museums); by limiting fees; by introducing independent oversight over re-use rules among EU member states; and by making machine-readable formats the norm. The EC target is that the formulation and implementation of open public data is carried out in all member states by early 2013 [5].

The PSI directive lead to several implications for the cultural heritage sector – the directive has made its entrance, and archives are now expected to open up, letting the material “out” and the citizens “in” in a much more innovative way [5-8]. Moreover, this is in line with policy goals such as increased productivity and improved effectiveness, efficiency, information quality, interaction mechanisms, better governance tools, and the advancement of government coordination and collaboration [9-15]. In short, openness is expected to facilitate democratic processes and the knowledge society, besides increasing innovation and the development of new or improved digital services.

Dealing with openness intellectually is no problem; most people would agree that developing new archival digital services is for the common good. In practice, things are seldom as easy as they seem. There is a list of challenges that archives must handle to open up their information, and these are not only of technical nature. Instead, they range from common policies concerning objectives, strategies and methods, via technical infrastructures and interoperability issues to administrative and organizational challenges [16]. In other words, altogether these challenges often lead to a delay of policy implementation. As there is a list of challenges, there is also a list of obstacles. Our assumption is that just like e.g. agile methods need to shift due to changed conditions, so do the policy implementation processes’ preconditions change over time. Thus, there is a multitude of reasons for this shifts and changes, but for now we will focus on organizational culture.

In this paper we report on findings from two R&D projects. The first project was the Access to Public Information: e-services in Government Agencies and Archives (APIS) project, which set out to explore the preconditions for creating border crossing digital services based on archival material i.e. whether there were any legal constraints that prevented this. The result showed that the legislation in Estonia, Iceland and Sweden is similar, and builds on the idea that all public information should be free to access by citizens. Another similarity is that legislation is at present being updated and adapted to cover digital records as well, although there are still laws that do not cover electronic information.

The second project, You! Enhance Access to History (YEAH), started with the intention to create citizen-centric digital services on archival material in line with the PSI directive, and this should be done through crowdsourcing. The project got a slow

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1 The APIS project website: https://sites.google.com/site/theapisproject/ [2012-10-03]
2 The Estonian Public Information Act RT I, 06.01.2011, 26
3 The Icelandic Administrative Procedures Act No. 37/1993
4 The Icelandic Information Act No. 50/1996
5 The Swedish Freedom of the Press Act SFS 1949:105
start, and what especially puzzled us were the continuous discussions that seemed to stem from a wish to guard, or protect the information held in the archives. Some issues were repeatedly brought up to discussion, e.g. concerns around the responsibility for the material and where this resides; thoughts about what happens if the information added by a crowdsourcing citizen is wrong; and questions such as whether these changes and the related metadata should go back to the archives. In essence, openness showed up to be a tricky matter for a sector that long has concentrated on preservation.

Following this, the aim of this paper is to explore the organizational culture and its influence on an open data policy implementation process. We will provide a model that constitutes the first contribution towards describing and explaining a policy implementation process that is drifting away from the policy objectives, thereby expanding the time frame for implementation.

The remains of this paper are structured as follows: first we describe our methodology, before we provide an account of archives and their organizational culture, and the empirical material underlying this case study. This is followed by a description of the theories we have used. Thereafter a discussion of our findings is presented followed by our conclusions and our Model of Drifting Processes.

2. Method

This paper is explorative, and describes a case study, that is an investigation of a process. Our research started with wondering why the idea of opening up the archives, and facilitating access to the material with the help of citizens or end-users, met opposition. The case study is qualitative, and aims at insight, discovery and interpretation, rather than hypothesis testing, in line with Merriam’s recommendations [17]. It explores the process of implementing the policy of open data – the PSI directive – in its real-life context [18].

The empirical material is gathered by one of the authors and it stems from two connected projects and consists of various project documents (project descriptions, meeting notes, e-mails and reports), collected by the author from January 2011 until today, from observations during projects meetings and discussions, and finally also from a semi-structured interview. As such, it involved frequent visits to the two field sites, and this happened over an extended period of time, as suggested by Walsham [19]. In addition, the author involved in the projects has a history of research in collaboration with the cultural heritage sector, and is well acquainted with the archival context [e.g. 20, 21, 22].

Based on the project documents and the observations, we identified the organizational culture as one possible factor that hampered the project, a project that aimed at contributing to implementation of the PSI directive. Hence as the next step we turned to theories on organization and open innovation, with focus on organizational culture and its characteristics. Thus, our approach is inductive, since

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6 The project team consists of people from National Archives in Estonia, Iceland and Sweden, an Estonian company and researchers from Luleå University of Technology. However, for the purpose of this paper, emphasis is on the Swedish situation.
the process started with reflections on the empirical, before turning to theories [17, 18]. Moreover, the theories we use constitute part of an iterative process between data analysis and the theories [19]. Our aim is to expand theories on organizational culture by emphasizing its significance for open data policy implementation.

The case study ended with an interview with the Director General of the Swedish National Archives (SNA)7 around the theme “Open Data and the National Archives”, with specific focus on organizational culture.

Our data was first openly analysed; focusing on identifying what characteristics of the organizational culture could be discerned in national archives. The analysis continued by discussing the findings in relation to theories on organization, culture, organizational culture and open innovation.

3 The Archival Organization, its Context and Culture

Archives mission is to secure the long term existence of archives, i.e. that archival materials are preserved, taken care of, and made accessible for current and future generations [23]. The intention is to safeguard the societal memory and the cultural heritage, and to guarantee information needs for jurisdiction and governance in a democratic spirit. Since National Archives are regulatory governmental authorities, their responsibility is nationwide, and laws and regulations regulate their work.

The Swedish National Archives (SNA) was officially founded in 1618, something that makes it one of the oldest Swedish authorities8. As such, SNA has a long history and their organizational culture is old and solid, built up during centuries. Today SNA has its head office in Stockholm9, and employs around 600 persons. A General Director whom holds the position for a time period of 6 years runs it.

From the beginning the archives preserved hand-written documents that needed a certain care and attention. The temperature and degree of humidity must be accurate so the material would not be damaged or destroyed. Another aspect is that it was necessary to be able to find documents and records; hence a system for how to arrange the archival collection was created.

Besides collect and preserve, archives are also expected to make their collections accessible [23]. For that reason reading rooms were created, where citizens could come to the archives, ask for documents and records, put on some white cotton gloves and read the document of interest, something that of course still is possible. IT, however, changes archives, and makes also access into something completely different, opening up for new, extended possibilities and easy ways to view archival material. This work has started, mainly by digitizing archival collections and making them accessible through websites, but so far it is only a small amount of archival material that is digitized. Moreover, contemporary access services in memory

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7 The interview took place at Luleå University of Technology Oct 23rd 2012
8 Not all National Archives are that ancient though, the Icelandic National Archives is only 130 years old, and the Estonian National Archives started in 1920.
9 It also includes the Military Archives, the Research Center SVAR, Media Conversion Center and the Regional State Archives, situated around the country.
institutions are more organization-centric than user-centric and the services are developed based on how things functioned in an analogue world [22].

That information is free to access does not mean that it should be available for anyone to use. There are a number of restrictions, of which the first concern personal integrity and aims at securing the fundamental rights of individuals10. Other restrictions are found in regard to national security11 and aim at ensuring that information which might endanger the safety of the state should not be possible to access. Therefore, public information is not automatically official – public information must be classified as official and not as secret, in order to be accessible. Hence, when implementing the PSI directive, it is necessary to be aware that there can be restrictions regarding the material, and thus, one need to be attentive of any law that might influence if and how government data can be open, if at all.

1.1 The Projects

The first project, running during 2011, went as planned, as a one year pre-project aiming at settling the preconditions for the follow-up project. The project team is the same in both projects, and consists of two persons from the university area, seven persons from three National Archives and one person from an SME. As such, the project members come from different sectors, and accordingly with different organizational culture experiences. In addition to that, it must be remembered that the organizational culture might also differ between different areas, between different organizations, and between different departments.

The first project focused around citizen-centric digital services, and there was agreement on the vision to collaborate and coordinate material from the Archives, Libraries and Museums (ALM) sector, in order to provide citizens re-designed, new and innovative digital services. The project conducted a comprehensive investigation of the area, decided to focus on archives, and develop a shared framework for new and unified digital services in archives. The project results were a report on the legal frameworks, how access is granted today, and main gaps and challenges for providing seamless access digital services to public information in the Nordic-Baltic region.

The second project soon encountered difficulties. The project started in December 2011, and in January 2012 the project team decided that the project would aim at “enhancing descriptions of digital objects in existing archival collections by crowdsourcing, in order to improve the description of archival material as well as to improve access to the same12.” However, crowdsourcing was immediately debated as there were many concerns of what this might imply and what difficulties it could bring along for the archives. As a result the project team decided to instead look into Linked Open Data (LOD). Even so, the discussions went on, hampering the project, and during autumn 201213 the project team stated that there was need to meet face to

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12 Meeting notes, 2012-01-18
13 Meeting notes, 2012-09-04
face, to decide: a) Type of data b) Find a partner that link open data, and c) an idea of how it technically will work. The face to face meeting took place in Estonia October 2012. By then the project had made a review of what crowd sourced archival material is found today, and the project team had made several suggestion of possible scenarios for the project to go on with. Nevertheless, the project team reasoned that “the train had left” and it would be hard to make any new or innovative contributions through crowdsourcing. Hence, it was decided that LOD was a more interesting and of more value to the citizens. The project is on-going and today a common understanding of what the project aims to achieve is finally reached. The expected result of the second project is “a demonstrator for any memory institutions to open up their data and link their cultural heritage information to the semantic web.” It is also decided to focus on genealogists and to narrow down the material to look into by an intuitive interface. The project will thereby provide a simple methodology to annotate relevant holdings. Finally a methodology handbook will be written, on how to create cultural heritage open data and link it to the semantic web. The project is to end by April 2014.

1.2 Organizational Culture

The initiative of Open Data will be central, said the General Director, since the PSI directive makes it possible to ask new and other questions than the initially intended with a material. Open data is of strategic significance and of huge societal relevance, but most important is that the material or information is actually being used.

The General Director emphasized that SNA should not regulate the use of their information. It lies in the Internet’s nature, archives cannot be open and available while simultaneously be in control. Personnel in the cultural heritage sector and memory institutions to some extent reckon that they “own” the information, and are happy to be generous – on their own terms. This stems from tradition; archivists have been regarded as keepers of the archives [23]. Now IT replaces archivists’ responsibility as keeper of the archives, IT replaces the term archives as premises, and IT has become the carrier of the societal memory, a task which has been assigned archivists for centuries [20, 22]. Again, archivists work situation has changed profoundly the last decades.

The work to change the organizational culture at SNA has started and to succeed, “you need to nag, and focus on changing attitudes.” But SNA has well established structures, and there exists a fear that others will manipulate the material – “they might do anything.” This the General Director regarded as irrelevant, since the originals are in safe care at SNA. In this work they emphasize processes, which should be coherent. The recent merger of regional archives with SNA into one authority provides a good opportunity to re-create the authority culture, work on basic values, and define the mission together.

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14 By April 2013 the second project have had 21 meetings in total, of which 3 has been face to face.
15 Meeting notes 2013-03-25/26
Thus, the organizational culture is deeply rooted, and the elusiveness of the digital is frightening. That archival material is everybody’s property is hard to accept, and the limit for where the SNA responsibility ends is unclear in personnel’s minds. Overall, the archival personnel act very aware of the responsibility and they fully shoulder the same by being competent, knowledgeable and loyal to their organizations. Their professional identity builds on this responsibility, and a sense of duty to really preserve the cultural heritage. The General Director also said that “What archivists have in common is a great love for the archives. But our responsibility, only comprise that the material exists, that it is authentic and that it can be understood in its context. What others does with this material or information later on can never be a responsibility for the archives.”

The positive aspects of the organizational culture in SNA are a love for the mission, continuity and stability (which is fundamentally a good thing, but might impede), and the fundamentally positive attitude towards openness, said the General Director. What might be improved is self-reflection, to see oneself and the archival mission in relation to society. It is important to view the archives as societal resources, he concluded.

4 Open Organizations and Culture

Traditionally, public organizations have had common characteristics such as rational rules and procedures, structured hierarchies, formalized decision-making processes and advancement based on administrative expertise [24]. These organizations have also, for a long period of time, been subject to political control rather than market control. Hence, these organizations are affected by the underlying political ideologies and thus cannot be equated with productive activities in the private sector [24]. Public organizations are also oftentimes viewed as less prone to answer positively to new requirements such as volatility and virtuality [25]. Now there is an expectation on public organizations to shift control mechanisms and to become more market oriented with increased competition and become responsive to the changing economic environment [24, 25].

The increasing expectation on organizations in general, to open up has led to a situation where many organizations strive to balance between closed and open approaches since too much openness can negatively impact the organization’s success due to e.g. loss of control [26], and a closed approach does not support the increasing demand to innovate [e.g. 1, 27]. This means that organizations can adopt an open approach along a continuum from closed to open, hence, it is not an “all or nothing” approach [28]. But to implement an open approach, there is a need to modernize and transform many organizations’ processes, which often has occurred by adding an open perspective on top of existing processes instead of creating radically new ones [3]. Opening up organizational processes is also to some extent, an individual pursuit since the implementation of an open approach is dependent on the personnel within the organization who defines the degree of openness they apply [29].

When it comes to the organization as such, their ability to adopt a particular approach is affected by many aspects such as, for instance, the organization’s
characteristics such as culture and structures, their technological infrastructure and their context [30]. According to Parker and Bradley [24], research on organizational culture indicates that the culture is of vital importance when implementing change processes. In addition, from a policy perspective, an awareness of the culture provides a foundation for both explaining and assessing the appropriateness and outcome of the policy to be implemented [24].

However, defining exactly what an organizations’ culture is can be rather difficult since many definitions exists, but there is a broad agreement that organizational culture can be viewed as the deeply seated values and beliefs shared by the people working in the organization [31, 32]. Values are the deepest representation of culture and can be defined as a conception distinctive of an individual or characteristics of a group [32]. The organizational culture can also include behavioral patterns and attitudes, behavioral norms, as well as artifacts that give shape to the identity of an organization. In this context, an artifact refers to rituals and ceremonies, stories, arrangements and language created by an organization. Together with behavior patterns these build the most visible level of organizational culture [32]. These visible elements can be gathered under the term practices. Behavioral norms can be represented by expectations about behavior or its results that are shared by a social group. These can be viewed as social principles, goals, philosophies, and standards that define attitude and legitimate specific behavior. The organizational culture fills the gaps between what is formally expressed and the activities that are actually happening [31].

One very well accepted approach to understand organizational cultures is the competing values model [33, 34]. The main advantage of the competing values model, according to Ovseiko and Buchan [27] is that it makes it easier to grapple with the complexity of the organizational culture through its focus on key cultural characteristics. Based on these it is possible to use the framework as a basis for diagnosing and initiating cultural changes since it gives a framework that supports the discourse.

In the competing values model emphasis is put on the competing tensions and conflicts that exists within any human system with special attention to the tension between stability and change, and the tension between the internal focus and the external focus [33]. In this framework, an organization’s culture is defined as the connection of aspects such as, strategy, politics, interpersonal, and institutions in an organization by organizing the different patterns of shared values, assumptions, and interpretations. In the competing values model two dimensions are distinguished representing an organization’s competing values. The horizontal dimension reflects the extent to which extent the organization focus on change or stability, i.e. centralization and control versus decentralization and flexibility [27, 33]. The vertical dimension reflects the extent to which organization focus on its internal context and processes versus the external context and relationships with stakeholders outside the organization. From the juxtaposition of these two dimensions, four cultural archetypes emerge which all have their underlying assumptions of motivation, leadership and effectiveness [33]. These cultural archetypes are known as (1) the entrepreneurial (also known as the developmental) type, (2) the team (group) type, (3) the hierarchal (bureaucratic) type, and (4) the rational (market) type [27, 33-35], see figure 1 below.
Figure 1. Competing Values Model Framework, after [33]

The entrepreneurial type
This development culture, also called the Open Systems Model, emphasizes flexibility and change, and focus primarily on the external context. In this type are growth, resource acquisition, creativity, and adaption to the external context of vital importance. Leaders tend to be future oriented and encourage entrepreneurial spirit as well as inspires to creativity with the intention to acquire additional resources for the organization [33, 34].

The group type
In this group culture, also called Human Relations Model, emphasis is put on flexibility and focus mainly on the internal environment. Organizations with this type of culture tend to be focused on group maintenance. Here are values such as belonging, trust, and participation at the core of the organization. Leaders are focused on teamwork in which empowerment of the employee, mentoring and support are core [33-35]. This effectiveness of this type of organization is based on criteria such as the development of human potential and member commitment.

The hierarchical type
The hierarchical culture, also called Internal Process Model, emphasize internal efficiency, uniformity, coordination and control [33]. Within this type of culture the focus is on stability where the purpose of its actions tend to be execution of regulations. Leaders in this culture type tend to be conservative and cautious, and strict guidelines tend to direct behaviors [34]. In this somewhat rigid context, employees
tend to value job security. The effectiveness of this organization is based on criterions such as control, stability and efficiency.

The rational type
In the rational culture, also called Rational Goal Model, emphasis is put on control and the external context. This culture stresses productivity, performance, achievements and competition [34]. The purpose of these organizations are goal attainment hence, leaders tend to be directive, goal-oriented, instrumental and functional and they are continuously providing structure and encouraging productivity [33]. Through its goal orientation, employees actions are controlled while behavior is directed towards the external context [34].

Usually, an organization’s culture are unlikely to reflect only one cultural type, it rather has flavors of the characteristics from all the types, but one of them can be more dominant [27]. Important to note is that when aspects stemming from one cultural type is over accentuated, an organization can become dysfunctional and the strengths with a culture can become its weakness [33]. For example, too much flexibility can end up in chaos, or too much order can end up in a rigid organization.

When it comes to organizational culture in organizations that strives to be more open and facilitate innovation, Herzog [32] has acknowledged that employees’ personalities are important factors in the open innovation mentality and those influencing the culture most is the management. They need to facilitate cultural change, new thinking, and clear mandates to make use of external ideas for innovations. Management also needs to motivate their employees. Herzog also argues that the culture in organizations aiming to adopt an open innovation approach needs to be risk taking. Engaging in open innovation requires an understanding from the organization that they most likely need to reconsider what value is and how it can be captured [29] which can imply that the organization need to alter the mentality of the organization [29]. The organization also needs to be responsive to exploration and exploitation needs by adopting a flexible and professional mentality [36].

5 Discussion

First, it is important to keep in mind that there are several reasons that can make implementation processes drift, ranging from the persons involved, their personalities, experiences and their different backgrounds, to country specific culture and organizational culture. The fact that the project team members come from different sectors (university, archives and SME) could therefore be one reason for the projects’ difficulties. Moreover, organizational culture is not static, as well as it can differ between similar organizations, departments etc. As can be noted, the General Director is not embracing the organizational culture to the same degree as employees in the National Archives. Having stated that, we specifically concentrate on the overall organizational culture that can be discerned in archives, and we do so in relation to the idea of openness, as expressed in the PSI directive.
A mission to preserve societal memory is followed by a responsibility. Working in archives puts personnel in a position where they are expected to collect and safeguard evidence and memory of how the society is designed at different times, and how its organizations function and perform. This responsibility colors the culture; by emphasizing the importance of keeping the material intact there is an implicit message – to protect it. When protecting something, control is vital. We argue that this perspective collides with the objective of the PSI directive. The fact that the PSI directive is aiming at openness and brings along the sense of “letting archival material out” is what makes it problematic. There is an inherent discrepancy between the mission of the archives (preserve and control) and the idea of openness. In the projects, this becomes one cause for the project process to drift away from the objective. Moreover, opening up an organization and encouraging other to contribute to their organization includes some risk-taking. In the organization culture studied here, the level of risk taking is rather low since their main objective is to care for, and protect the archives. This implies that the organizational culture somewhat collides with the nature of the policy of open data, which can make the implementation process of the policy more cumbersome and time-consuming.

Archivists belong to a specific community of practice that reflects their work conventions and understandings rather than innovation. Members of communities apply their knowledge within their context and the knowledge within that context is blended with their competence and skills. These, in turn, are formed by the community’s values and norms [25]. In our case, the archivists live with norms and values such as protecting the material in the archive. There is need for shift of understandings, i.e. that archival material can be open while simultaneously still in safe care, and this work is on-going at SNA.

In addition it is essential that the archival community avoid a multitude of different solutions and ways of doing things. This is important because it lays the foundation for synchronization, co-ordination and joint search and retrieval tools for end-users of archives. Technical solutions must be secure, archives cannot risk losing neither material nor metadata during e.g. transfer of records, which is one part of the long term digital preservation process [16]. This also means that the implementation of a policy such as the PSI directive is to function, not only in single organizations, but in a network of organizations, i.e. in a community. This is something that contributes to the complexity of the policy implementation process and therefore also could lead to a drifting policy implementation process.

We argue that depending on what type of organizational culture that prevails, the distance between the organizations current situation (in relation to what the policy aims for) to an implemented policy, differs. An organization with a flexible, adaptable, creative and risk-taking culture can be expected to more easily adopt and implement a policy such as the PSI directive with its open and market oriented nature. The culture in the organization in our study is less prepared for that new line of thought, built on openness, since it is basically a hierarchical culture that is built on stability and control [33]. This means that the organization needs to move towards a more open system approach built on values such as flexibility and change in order to implement the directive. In turn, this also include moving from an internal focus to an external focus.
Moreover, the case described above can be viewed as to some extent collide with the EC’s somewhat technological deterministic view, i.e. that technology will solve it all [37]. When technology does not do this, the action taken is an overview of laws and regulations [6]. But policies concerning IT related implementation have both material and social dimensions [38] therefore policies that build on technological possibilities require actions from human actors, in order to be implemented. Policy making at European level can of course not focus on individuals in every organization. It is each and every organization that must translate the policy to their context, and transform or adapt their organization in order to implement the same. And the organization must encourage their personnel to accept and adopt the changes needed. The PSI directive is an IT driven initiative, and if the personnel do not adhere to this, they might choose to do differently [39]. This does not mean that the PSI directive never will succeed, many times change happen incrementally, through small adjustments in every day work [37]. It can also be argued that perhaps it should not succeed, and that not all data should be open data, even if it is public. However, this discussion is outside the scope of this paper. For now we claim that if the organizational culture, with its accompanying values, behaviors and artifacts [31], is not in line with the implicit nature of the policy the time to fully implement a policy is extended; the implementation process is drifting away and the organization does not reach the policy objectives.

6 Conclusions

This paper aimed at exploring organizational cultures’ influence on the time-span of policy implementation. It is the first attempt to illustrate, describe and explain the drifting policy implementation process in a model (Figure 2 below). The simplicity of the model offers a tool for appreciating and modelling aspects that needs to be considered, as they are influencing the time frame for policy implementation. In other words, the model can be used by organizations to facilitate understandings of and communication on different aspects that influences the policy implementation process, causing either progress towards the intended policy goals, or making the process drift away from these. However, we intend to elaborate more on the model in the future. For now, our conclusions are as follows;

- Governmental policy objectives must first be translated and understood in the community, for coherence, synchronization, and co-ordination.
- Individual organizations also need to understand and translate the policy in relation to their specific culture.
- Policies are more or less in line with the organizational culture in organizations, hence organizational culture type influence the distance to a successful implementation when the policy is initiated (the y axis in Figure 2 below). This means that some organizational cultures are initially much distanced from the objectives of the policy to be implemented, while others might almost, or already, have reached these. The y axis then, denotes an
appreciation of how far or close an organization is to have implemented the policy objectives.

- Organizational characteristics such as, values, behaviors and artifacts that are related to the organizational culture type influence the time span for policy implementation (the x axis in Figure 2 below). These thoughts constitute the basis for our Model of drifting processes, found in Figure 2 below. The dotted arrow illustrates the desired process for the policy implementation process.

![Figure 2. Model of a drifting policy implementation process.](image)

- Different actions, such as knowledge creation, decisions, arrangements and interventions taken during implementation might either increase or decrease both distance as well as speed to policy implementation (curved arrow above), i.e. an active and goal directed work to accomplish the implementation will reduce the time span. In turn, this contributes to reach a successful implementation of the policy within specified time frames.
- The actions together with degree of coherence between policy, culture type and culture characteristics decreases the distance to implementation. This means e.g. that an organization that starts with a small distance to successful implementation when the policy is initiated, but which does not act towards the goal, will experience a long time span, and is therefore not successfully implementing the policy within expected time frame (dashed arrow).

Finally, our research shows that organizational culture type, and the cultural characteristics such as, values, behaviors and artifacts connected to the same influences the policy implementation process. Having concluded this, we once again want to stress that there are other factors influencing this type of implementation processes, e.g. knowledge, structures, strategies and technological infrastructures, which are equally important to take into consideration.

Additionally, it would be interesting to try the model in other contexts than the cultural heritage sector. We hope to elaborate more on these in further research. Finally, the question of the aims and intentions following the PSI directive is another
issue that could be further explored. It is possible that what, when and how data should be open, even if public, should be more investigated.

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References


Defaulter Tracing Information System for Maternal and Child Healthcare

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Abstract: Health Information System (HIS) studies in developing countries have a strong focus on upward information flow; from the lower to the higher levels. This paper contributes to HIS in developing countries debates by showing the importance of horizontal flow of information both at facility and community levels in defaulter tracing information system in maternal and child healthcare in developing countries settings. Defaulter tracing information system depends heavily on horizontal flow of information between facility and community. Defaulter tracing information system is also mediated by social-cultural issues such as rural and urban contexts; nature of the health service program; HIS design and implementation; and logistic challenges. Lastly, the paper provides HIS design and implementation implications in order to support defaulter tracing practices in maternal and child healthcare.

Keywords: Defaulter Tracing Information System, Maternal and Child Healthcare, Health Information Systems, Developing countries

1. Introduction

With two years remaining for Millennium Development Goals (MDG) deadline, World Health Organization (WHO) claims that few African countries have achieved the target set (www.who.int). Three goals out of six are related to the well being of infant/child healthcare; reduce child mortality, improving maternal health and combat HIV/AIDS, malaria and other diseases (ibid). For effective healthcare provision for children under five years old, pregnant women have to be enrolled into antenatal care, deliver with assistance of skilled attendants, receive postnatal care and their new born children have to be enrolled into postnatal care and children under five year old clinic. Health workers also need to have continuous contact with pregnant women, children under five years old, and the general population so that continuity of care can be assessed and remedial action taken when need arise. For example in case pregnant women and children have not kept their appointments, health workers need to trace defaulters and remind them. The general population must also have education about health issues and how to take care of pregnant women and children. Undesired traditional practices such as home delivery with unskilled attendants; poor nutritional practices taboo for the pregnant and children; female circumcision and gender inequality should also be discouraged.

Continuity of care can only be achieved through having an effective information system in health unit that will increase client compliance with curative and preventive care (Bodart and Shrestha, 2000). One aspect of health care is involvement of providers with different specialties and/or organizational structure. For example, pregnant women healthcare is performed in antenatal care units, delivery unit, Prevention of Mother to Child Transmission of HIV (PMTCT) unit, immunization section, laboratory, HIV section, and medical unit. These units are likely to be geographically collocated or distributed. To trace defaulters, collaboration need to be extended to the community level. The collaboration involves horizontal flow of information between the providers within health units and communities so that knowledge about which patients are in need of what kind of follow up at what time is known to all those involved in patient care in the area. However, the current approaches to Health Information systems (HIS) design and development in developing countries are a bit biased. Both policy makers (health officials at the ministry) and researchers have given much attention to aggregate or statistical data which flows vertically from health facilities to district, then to the national level. Krickerberg (2007) argues that HIS in developing countries have been built with the intention of providing routine information to higher level health administration. The reasons for the aggregate data focus might also be a result of computerization which was done in phases; starting from national level cascading to district level (Wilson, 2000). It might also be because of prioritizing policy needs; obtaining information which could help decision makers perform health needs assessment, and planning and monitoring of health service.

This paper describes horizontal information flow in maternal and child health care both at facility and community levels. It contributes to HIS in developing countries debates by showing the importance of horizontal flow of information both at facility and community levels. Defaulter tracing information system in maternal and child healthcare is my empirical focus. The paper provides the overview of information system for tracing defaulters in maternal and child healthcare in developing countries settings and compares village health workers and community home-based care providers’ defaulters tracing activities. Not the least, the paper shows the importance of community and community based information systems in supporting defaulter tracing activities. There are few information system studies which reports defaulter tracing activities in other health programs in maternal and child healthcare such as vaccination services. Most studies regarding defaulter tracing activities are oriented towards vertical programs or chronic diseases such as tuberculosis, HIV/AIDS and PMTCT (see for
example Fraser et al., 2009; Jones et al., 2005; Kalembo and Zgambo, 2012; Nglazi et al., 2010, Buza et al., 2012; Marcos et al., 2012). Defaulter tracing activities in maternal and child health services are potential for addressing MDG 4 and 5. The paper provides rich insights about information systems to support defaulter tracing in maternal and child healthcare in developing countries. Engestrom (2001)’s activity system framework is used to provide the structure of defaulter tracing activity system in vaccination and PMTCT services. The paper also provides HIS design and implementations implications in order to support defaulter tracing practices in maternal and child healthcare. Not the least, the paper shows the importance of community and community based information systems in supporting defaulter tracing activities. The study draws upon insights from the socio-technical studies of technology, in which an information system is considered not simply a technical-rational process of ‘solving problems’; but also understood as involving socio-economic and social processes (Walsham, 1993).

The structure of the paper is as follows: following the introduction, the literature review is presented with focus on facility and community based information systems in developing countries contexts; then literature about defaulters tracing information systems is reviewed with the focus on the influence of socio-cultural issues. The last part of the literature review section presents the theoretical focus whereby activity theory is used and mediation concept is the theoretical focus. Sections 3 and 4 present the research context and methodology respectively. Section 5 presents research findings about vaccination and PMTCT defaulter tracing practices while sections 6 and 7 present analysis and discussions respectively. Section 8 concludes the paper.

2. Health Information Systems in Developing Countries: Facility and Community Based Focus

The primary health care strategy calls for reorganization of the health services system, adapting health care delivery to the needs and limitations at the community level, and involving the community in the planning and management of local health services (Kleczkowski, Elling & Smith (1981) quoted in Sapirie, 2000). Community-based systems include local community participation in planning, managing, and responding to the system and its information (Marsh, 2000). Community involvement could be done by restructuring of HIS in order to give health care managers and providers better understanding of the community needs and to increase community involvement in the generation and use of information (Sapirie, 2000).

Community based information systems stress local participation in responding to the health needs of all in the defined population, often through household and neighborhood level services, especially health promotion and disease prevention activities. Information systems in community based systems include patient based records, and community records. Individual based records are also generated by community leadership regarding data on the health status and living environment of the communities served, including data on births, death and on education (Marsh, 2000). People involved in data collection activities for community-based information systems are community health workers (CHW) and community council members.

In most countries, health facilities provide premises where modern curative, preventive, rehabilitative, promotive and palliative health services are offered. Information is collected during health service provision showing service rendered to individuals and schedules for future health services. Information generated at this level includes patient’s records about their diagnosis and treatment, health education and counseling activities (Lippeveld and Sauerborn, 2000). There are also records created for vital registration for births, deaths and migration (Sapirie, 2000).

Community and facility share needs in information such as demographic data, health care coverage, health status, quality of care and financial information. Marsh (2000) argue that community based approach in some cases would allow identification of affected individuals, many of whom were invisible to the health systems because of incomplete coverage.

HIS is one of important tools for the health sector which involves stakeholders situated at national level, regional, district, service delivery and community. Vertical information flow denotes transfer of information at certain intervals (daily, weekly, monthly, quarterly) between levels of healthcare such as community, health facility, district, regional and national level (Shrestha and Bodart, 2000). Upward flow of information provides means mechanisms through which higher levels get awareness of health services at immediate lower levels. It could be through special program reporting or routine reporting (disease incidence or summary reports).

Special program reporting involves upward flow of information to the higher levels from basic services level for special programs such as for tuberculosis control, leprosy control, malaria control and AIDS prevention. Routine reporting are reports created from patient encounters in health facilities or through outreach programs (Lippeveld, 2000). Routine data collection and reporting can also be managed directly by the community. For example, some data in the community is reported to nearby health units, such as immunization and home-based care activities performed by CHW (Marsh, 2000). Vertical flow of information could also occur between health units when clients are referred from lower levels to higher levels (Lippeveld, 2000).
Horizontal flow of information refers to transfer of data among actors and consumers at the same level of the health care system (Shrestha and Bodart, 2000). In a district-centered primary health care approach, users should include the community, the local health facilities, the district, central levels and other sectors relevant to health such as agriculture, education, housing, finance and planning (Sauerborn, 2000). Some reports could also be sent to special programs or projects or development partners in which the community council members are involved.

2.1 Defaulter Tracing Systems in Vaccination and PMTCT Health Services

Defaulter tracing information systems can be defined as procedures and tools which enhances following up of patients who have dropped out of health programs. For instance, vaccination drop out rates can be defined as proportion of children who received the first type or dosage but not the last type or dose of a certain vaccination (Chadambuka et al., 2012). For example for vaccinations, drop out rates can be BCG to measles or Penta1 to Penta3. Reasons for drop outs in vaccination include distance from health facilities, transport cost, and other social issues (Cutts, 1991).

There are social contexts which influence immunization service in general and defaulter tracing information systems in particular. For example, Chadambuka et al., (2012) reports a study where immunization activities and routine immunization registers were not updated routinely and defaulter tracing was rarely conducted.

Contextual factors such as rural and urban differences can have impact on immunization services especially regarding community health workers, community leaders and immunization services (Cutts, 1991). For example in health services communication and information dissemination, urban people are likely to have access to modern communication facilities, and they have higher school enrollment and higher level of education which facilitate information dissemination even though the characteristics are not necessarily uniform (Cutts, 1991).

Approaches for tracing immunization defaulters include using community health workers, house-to-house visit, telephone calls or written reminders (Cutts, 1991; Chadambuka et al., 2012; Marsh, 2000). Message to communities about immunization activities can be disseminated through schools, religious organization and influential leaders (Chadambuka et al., 2012, Cutts, 1991). The ability of health workers to communicate with the community (social mobilization) is equally important for improving vaccination services (Chadambuka et al., 2012) such as announcing outreaches service session cancellation or vaccine stock out.

However, in urban contexts, seasonal movements into and out of residential areas could make defaulter tracing activity difficult (Cutts, 1991). Community leaders in urban areas may be more difficult to identify, have less time to devote to voluntary services, and have less widespread influence on community behavior (ibid). Also the competing priorities and high migration rates of urban families tend to reduce the use of health services. In urban areas there could be minimal lines of communication between health workers and the community and higher drop-out rate among urban community health workers because of the low pay (Cutts, 1991).

Transmission of HIV from mother to child can take place during pregnancy, labor, delivery, as well as after birth via breastfeeding, especially in mixed feeding (Kalembo and Zgambo, 2012). Follow up in PMTCT is done for various purposes, for instance identifying children with HIV and ensure timely initiation of treatment and care and to avoid postpartum HIV transmission and administration of a short-course antiretroviral treatment to exposed children (Kalembo and Zgambo, 2012). Effective HIV treatment requires good information management to ensure that patients are identified and traced on time. Failure to retain a high proportion of patients in care negates much of the potential benefit of antiretroviral therapy (ART) treatment programme (Forster et al., 2008).

Defaulter tracing activities have been emphasized in PMTCT services and the term ‘lost to follow up’ is commonly used for the activities. Nglazi et al. (2010) defines loss to follow up as patients who had failed to attend the clinic for more than 12 weeks and who were not known to have died or been transferred to another ART clinic. However, Fraser et al. (2007) assert that there are several criteria for tracing patients in PMTCT services; missed clinic appointments, initiation of ART therapy, laboratory check up, ART drug out of stock, and patients with TB. Lost to follow up can be associated with these criteria even though the term have been mostly used for missed appointments (ibid; Tanzania guidelines on HIV care). In PMTCT, several factors are associated with lost to follow up including stigma and discrimination, home deliveries, and social economic factors.

PMTCT services trace defaulters by several approaches such as using phone call, outreach teams, collaboration with community-based organizations, using community health workers and using social workers (Forster et al., 2008; Fraser et al., 2007; Thomson et al., 2010). Information tools used could be list of patients from medical or pharmacy based records, follow up forms, paper-based booking and attendance diary system and reports about follow up activities (Fraser et al., 2007; Thomson et al., 2010; Nglazi et al., 2010). Thomson et al.(2010) provide an example of a defaulter tracing system in a HIV/TB program with the following procedures: patients enrolled into program; patient misses scheduled appointment; patient identified as potential defaulter through daily paper register; social worker traces patient (via phone, home visit), social worker completes tracing form and documents outcome (return to clinic, hospitalized, transferred out, refuses to return to clinic, unable to return to clinic, confirmed dead); and routine data entry and analysis of tracing of defaulters. However,
contextual issues such as limited resources and poor information collection practices are likely to hamper the patient follow up activities in PMTCT services and client retention (Forster et al., 2008, Fraser et al., 2007; Thomson et al., 2010; Marcos et al., 2012).

Electronic Medical Record (EMR) systems could enhance tracing of patients lost to follow up through automated e-mail alerts to promote timely initiation of treatment and automated reports generation which can support the tracing of patients lost to follow-up by community health workers (Forster et al., 2008; Fraser et al., 2007). Other modern communication modes for improving follow up communication between health care provider and caregiver could be internet, intranets, telephone, video conferencing, email, short message service, and manual downloading of information (Gentles et al., 2010).

Forster et al. (2008) argue that the concurrent use of several strategies could be most effective in reducing losses to follow up. Community based approaches or strategies are among the approaches which can be used to improve care and retention in PMTCT in resource poor settings (Busza et al., 2012; Marcos et al., 2012). Factors influencing women to use PMTCT services cannot be adequately addressed by clinicians in healthcare settings alone and would be better addressed by personnel well-positioned to intervene at a community level (Marcos et al., 2012). Busza et al. (2012) defines community based approaches to PMTCT as 'strategies and interventions to improve health behavior and outcome that are delivered outside the formal health settings’. These approaches target their local civil or traditional authorities’ leaders or traditional health providers outside formal health sector. The community groups which could be involved are diverse and include community health workers, peer counselors, volunteers, TBAs, mentor mothers, traditional chiefs and religious leaders (Marcos et al., 2012).

2.2 Theoretical Focus: Activity theory
To understand defaulter tracing system in different context such as vaccination and PMTCT health services, activity system framework is employed. Activity system (AT) consists of minimal elements of subject, tools and object which are in mutual relationship (Kuutti, 1996). Third version of AT emphasize social cultural mediation of activity by tools, division of labour, object, community and actors (Engestrom, 2001). A tool can be material tools or thinking tools. Rules cover both explicit and implicit norms, conventions, and social relations within a community (Kuutti, 1996). Division of labor refers to the explicit and implicit organization of a community as related to the transformation process of the goal into the outcome. Figure 1 shows a pictorial representation of the activity system.

![Figure 1: The structure of human activity system (Engeström, 2001)](image)

Activity theory propose that activity systems itself is the context (Nicoline, 2013). An activity is the minimal meaningful context for understanding individual actions (Kuutti, 1996) Context is constituted through enactment of an activity involving people and artefacts. Consciousness and intelligence do not reside in individual heads or minds but in interaction; realized through socio-cultural mediation of material activity. The meaning of action and context in which it happens are not independent of each other: conception of work objects and contexts arise together as part of a single bio-social-cultural process of development. Activity system theory has been used by information systems researchers to represent the work and hence as source of design (Korpela et al, 2001).

3. Research Context
Health Information System Program (HISP) is the setting of the study. HISP is a collaborative research and development program comprising the University of Oslo and universities and ministries in a number of developing countries (Braa et al, 2004). The key areas focused by HISP are software development, research and training in Health information systems. The primary goal of this program is to enhance the information use
behaviour of health managers, planners and workers in the health sector of developing countries by strengthening local professional capacity for the development of sustainable HIS (Braa et al, 2004).

This study had been conducted in the Dodoma Region which is located in central part of Tanzania. The study was done in two districts namely Dodoma Urban and Chamwino. The study was conducted in six health facilities offering Reproductive and Child Healthcare (RCH). RCH aims at social welfare of women and children especially during pregnancy and children under five years old age. It consists of the following sections: children under five year old clinic; antenatal care; family planning; immunization and delivery ward. Nutritional supplement distribution and PMTCT are health service programs which can be performed to clients in all sections. Tanzania healthcare provision is divided into levels: national hospital; specialized hospitals; regional hospitals; district hospitals; health center; dispensary; and community. In the urban district, three facilities were visited whereby two are health centres and one is a dispensary. In Chamwino district, one health centre, one dispensary and one district hospital have been studied. The period of the study was from August 2011 to April 2013.

At the community level, health care provision includes home based care services for chronic diseases such as HIV, cancer and diabetes (Tanzania national policy, 2007). The lowest level of community leadership is ward which is divided into villages which are divided into hamlet or streets. Community leadership includes ward executive officer, village executive officer, village chairman and hamlet/street leaders. Households are within certain hamlet or streets which are headed by hamlet/street chairman. Hamlet residents register are kept by hamlet/street leaders and records information about household members such as their name and age, household leader, status (child, wife, husband, relative, etc).

Community government is responsible for mobilizing, educating and sensitizing community members to receive facility health services. Communities are also involved in taking actions and adopting behaviors that promote and preserve health. In community governments, there are committees for health, education and security and defense. In rural area, every hamlet would have a village health worker (VHW) who is a community link to the health facility (Tanzania national health policy, 2003). Communities are also involved through having representative mechanisms that allow communities to influence the policy, planning, operation, use and enjoyment of the benefits arising from health services delivery (Tanzania national health policy, 1990; 2003, 2007).

Tanzania like other developing countries is faced with problems of illiteracy, shortage of resources, low income, problematic traditional beliefs and low motivation to use modern health services (Tanzania Demographic and Health Survey, 2010). These factors have impact on healthcare provision such as clients’ discontinuity in health services and low utilization of maternal and child health services.

4. Research Methodology

A qualitative approach was favored because the research was concerned with exploring behavior regarding defaulter tracing information systems (Silverman, 2001). The study has employed case study methodology and my case study is ‘defaulter tracing work practices in the clinic for children under five year old age’ in RCH units. Empirical work has been conducted in health units and community levels.

The main method for data collection has been observation. I have observed work practices in children clinics, where the sessions has usually lasted from 8.00 am to 3.00 pm. I participated in a follow-up activity at the community level whereby we visited six households in search of defaulters. I also participated in community gatherings such as inauguration of a new vaccine at the regional, district and ward levels and national campaign for tracing defaulters at ward and facility levels. I also participated in facility meetings in two facilities where such work practices were discussed.

At facility units, I conducted interviews with health providers of different cadre such as four doctors, one health officer, twenty one RCH nurses, two HIV patient tracing coordinators in two facilities, six village health workers (VHW) and six community based HBC. The main theme of interviews was defaulter tracing work practices. At the community level, I interviewed two village chairmen, two village executive officers and six hamlet leaders. I also interviewed and held three focus group discussions with a total of eight traditional birth attendants and health providers.

At the district level, I interviewed coordinators for home based care, vaccination, PMTCT, HIV/AIDS and RCH. At regional level, I interviewed one health officer and coordinators for RCH &HIV/AIDS. The theme of my interviews with district officials was the essence of follow up practices and its relations to data management work practices at the facility level.

I also analysed patient retained cards (antenatal & children cards, CTC cards) and facility registers and other health services records. I analysed CHW data management tools and practices. At the community level, I have reviewed hamlet leaders’ residents’ records. I have also reviewed several policy documents such as Tanzanian health policy, RCH strategic plan, Home Based care policy and HIV act and policy.
The data has been analysed using interpretive approach (Walsham, 2005). During fieldwork, I took notes, and when appropriate I photographed or video recorded. But this activity was restricted in PMTCT and rural area where clients found it very uncomfortable to be photographed or video recorded. Later I created narratives (Miles and Huberman, 1994) which are some sort of analysis for detecting themes. It appeared that one of the narratives was related to the activity of tracing defaulters. I further conducted an in-depth study in order to expand the narrative by doing more interviews and observations. I then expanded the narrative by organizing it into different programs of vaccination and PMTCT and did comparison across them and between rural and urban contexts. When I was reading the story of tracing defaulters in vaccination, PMTCT and the comparison between them, a theme of horizontal information flow emerged and I then reviewed HIS in developing countries literature.

5. Research Findings

Tanzanian health policy entails that every child should be provided with one dose of BCG (Bacillus Calmette–Guérin), three doses of OPV (Oral polio vaccine), three doses of DPT-HB (Diphtheria–Pertussis–Tetanus), three doses of rotarix, three doses of PCV 13 (Pneumococcal Conjugate Vaccine) and one dose of measles vaccine (Tanzania national road map strategic plan to accelerate reduction of maternal, newborn and child deaths in Tanzania 2008–2015). Nevertheless, not all children are immunized or fully immunized, the current figure being 75% (TDHS, 2010). There are also variations in vaccination coverage between urban and rural; current figures being 86% and 75% respectively. There is also a trend in decrease in vaccination coverage between first and third dose of DTP-HB.

The government have set operational targets to be achieved by 2015 such as increased immunization coverage of DTP-HB 3 and Measles vaccine to above 90% in 90% of the districts; PMTCT services provided to at least 80% of pregnant women, their babies and families; 75% of villages to have community health workers offering MNCH services at community level; and reduced stunting and underweight status among under-fives from 38% and 22% to 22% and 14%, respectively.

To address the problem, district, facilities and communities has put several mechanisms including tracing of defaulters’ practices which involves collaboration between facilities and communities and data elements about drop out rates in monthly reports from facility to district. Some communities have set bylaws where community members can be punished such as setting amount of money to be paid in case of home delivery or if children have not attended vaccination services. However, these bylaws have to be approved by the legal department of the district administration.

The next sections present defaulter tracing for children of under five in vaccination and PMTCT services.

5.1 Vaccination Health Care Provision Work Practices

Recommended children vaccination schedule is at birth, six weeks, ten weeks, fourteen weeks and nine months. Children are enrolled into a child clinic. During vaccination service provision, records are created into a facility register and some information filled into children RCH cards. One aspect in both facility register and patient records is recording of residential information (address) and community leaders (such as name of hamlet leader). In facilities, community leaders’ names list is displayed in facility offices. Regularly facility registers is searched to generate a defaulters list which is always recorded on a plain paper. The list at the basic level include name of client, mother’s name, street/hamlet, service defaulted. The interval for generating the list could be daily, week, monthly; it differed from facility to facility and it depended on other factors such as workload of providers.

The next step after acquiring a list is to doing intervention by informing or reminding clients. Facility could use two approaches for communicatng: community engagement within the facility or community follow up.

a. Community engagement within the facility was performed in some facilities; it would involve nurses inquiring information from clients who are living in the same street as defaulters’ mothers during clinic sessions to give feedback or convey message to defaulters. The audience would respond with comments like client is doing certain socio-cultural and economic activities; migrated; travelled; deceased; or was visiting a certain family. Nurses usually evaluated feedback obtained from the audience and then either updated the registers or gave the message to be conveyed to mothers.

For some clients using community engagement within the facility was not an effective approach; perhaps the neighbors did not know anything about the defaulter; or clients ignored the message and did not come for services. Facility arranged for home visits in the community which could be performed by VHW (in rural area) or local government authorities (street, hamlet or village) or nurses. In case it was not nurses, defaulters’ list needs to be communicated to VHW or community leadership. In some cases, community leaders could inquire defaulter names from the facility management so that home visit can be done.

b. Community follow up activities - If nurses or VHW knew the location of the house, they would go and inquire from household members. If not they would inquire the household location or family details from
village authority. Mothers’ name/information was a key to find a child. Hamlet/street leader knows his members and their households’ location or could use hamlet residents’ records to find information about defaulters’ house location. Hamlet leaders could communicate directly with mothers and inform them that they are needed in vaccination services. In some cases, nurses/VHW could ask neighbors or any community member about the whereabouts of the defaulter’s mother. Finding clients is not easy. Some times it would take days to meet clients, or for messages to reach clients, especially during harvest and farming seasons in rural areas in which people move temporarily to remote areas. When mothers were found, providers would ask for the RCH cards of the children. The provider would compare personal attributes in RCH card and personal attributes in defaulters’ list. RCH cards would show children’s vaccination status. If RCH cards show that she is a defaulter, she would be advised to bring a child for vaccination. For some clients who would not abide with schedule, community guards could be sent to arrest them. During the home visits, nurses/VHW will be updating the defaulters’ list about status of the visit.

If follow up was performed by VHW or hamlet leaders, feedback about defaulter tracing activities would be provided to facility. The outcome of defaulter tracing activities is either children coming to vaccination services or registers updated with comments like deceased/migrated/ received in other facilities. Feedback could also be updating the register since vaccination services had been performed in the same facility but data was not recorded in facility registers.

Defaulter tracing activities information and reports are used within the facility and in the community. In facility meetings, defaulter tracing plans and activities are discussed. I observed that one facility had created RCH daily reports register where defaulter tracing activities plans for the next day were made. Other cases of uses of defaulter local reports could occur when facility staff communicates to hamlet leaders about low attendance of their members in vaccination services. It could also occur in village or hamlet meetings where community behavior towards health service usage is discussed.

5.2 PMTCT Health Care Provision Work Practices

In Tanzania, children born from HIV positive mothers undergo PMTCT child follow up services from birth until 18 month of age in a monthly schedule. The clinic involves children taking ARV for six months, being tested at four weeks, nine months and eighteen months. It also involves education and counseling about breastfeeding, nutrition practice (e.g. the child on exclusive breastfeeding should not have alternative food before six months) and prevention of other means of infection such as using common teeth brush and razor.

In HIV care in general and PMTCT, there is involvement of donors and non-governmental organizations such as TUNAJALI programme. TUNAJALI is a comprehensive HIV programme funded through USAID, aiming at engaging with Tanzanian National AIDS Control Program (NACP) and district councils within some selected regions (Iringa, Morogoro, Dodoma and Singida) to increase quality, synergy and a comprehensive continuum of care for people living with HIV.

The TUNAJALI program facilitates defaulter tracing for HIV services. Together with facilities management and district councils, every residential area has community based care provider (C-HBC) and/or some could also be connected to certain catchment health facilities. C-HBC gets allowance of approximately 30 USD per month from TUNAJALI programme. The program also provided mobile phone airtime allowance to health unit home based care providers so that defaulter tracing can be done through mobile phones. At TUNAJALI central office, there was C-HBC coordinator who could provide linkage between different C-HBC in the districts. In facilities’ CTC section you would find list of C-HBC for different residential areas.

Tanzania HIV care policy entailed that all clients diagnosed HIV positive would be attending CTC clinics regardless of whether they are on ARV treatment or not. When PMTCT pregnant women or children started CTC, they would be connected to C-HBC of their residential areas. One of C-HBC’s responsibilities was tracing and reminding clients about their continuum of care. In some cases especially in rural areas, C-HBCs were escorting their clients to the CTC clinic on the clinic days or would take drugs or provide information to the facility when the client was sick. C-HBC kept records of their clients (PMTCT pregnant women, PMTCT children and CTC clients) ranging from 20 to 30 clients according to C-HBC coordinator at central office. However, some C-HBC in rural areas through document analysis of two C-HBC records or one during interviews informed me that they could have up to 70 clients.

In PMTCT, follow up activities are supposed to be done for missing appointments, breastfeeding mothers, testing schedules and tracing if mothers have received the results, tracing linkage to HIV clinics when results are positive (Tanzania PMTCT guidelines, 2011). However, in facilities visited it was done mostly for missing visits and tracing linkage to CTC clinics due to higher workload and information systems limitation (tedious to search).

Information would be recorded for every visit in PMTCT mother child follow up register in RCH section. Tracing of defaulters’ activity would start by searching the PMTCT register (which does not records names and
mobile phone number). Local registers existed which recorded personal attributes such as name, mobile phone number and residential information. In local register, some clients provided mobile phone numbers of their relatives to be used when phone contact is needed and in such records phone ownership would be noted. PMTCT register defaulter list would be concatenated with child’s personal attribute from local register. Facility providers would make phone call to defaulters who have access to mobile phones. During phone call, the message to be delivered depended on the ownership of the phone. Provider differentiated phone calls between phone owners and those who used relative’s phones. For clients who had access to phone (relative or friend) provider would ask phone owner to inform client that was she was needed in a certain facility, while direct message would be given phone owner. However, some clients could not be reached due to changing phone number, or could not pick phone number or was unavailable. Providers informed me that some clients could be reluctant to release their phone number for recording and mobile calling.

For those clients who could not be reached through mobile phone plus those who do not own or have access to mobile phones, their names would be passed down to their residential C-HBC. Names of residential C-HBC could be found in CTC section. Again defaulters’ list for different residential area would be recorded on plain paper, even though the list would mentions no service for which the client had defaulted. Removal of some information contents is done for protecting privacy of clients. In other cases, for clients that because of no mobile phone access or due to a busy schedule could not visit the house, a letter with encoded message could be given to other clients informing mother to bring the baby to the clinic.

However, C-HBCs’ tracing activities were complex since it depended on willingness of clients. C-HBC knows mothers of children who are to be traced as C-HBC were usually introduced to pregnant women on PMTCT services of their residential area during enrollment into CTC healthcare. Even though C-HBC could know the exact location of house of the defaulter, going to the household was not a straightforward issue. In some cases, C-HBC would not go to clients’ household, because the client did not give permission for home visit. In other cases C-HBC could not convey message in presence of other relatives/people because they are unaware of HIV status of mother or a child. In such instances, provider would use other opportunities such as religious meetings, burial or wedding ceremonies or open day markets or on the road path. This had impact on information practices. For example some female C-HBC would have notebook in their handbag so that they can record any time when they meet clients while for others recording would take place later after coming back home.

Again, for privacy purpose local leaders (such as hamlet/street leader) were not fully involved. In case, client had changed house location, C-HBC could ask local leader or community members about house of clients but would not speak the truth why the client is needed.

Tracing activities could be extended to involve PLWHIV (association of people living with HIV) if it is known that a clients were associated with one. CTC patient forms recorded the PLWHIV/community support group which clients were associated with. PLWHIV/community support group members were also responsible for reminding each other about appointments. In areas where there were no C-HBCs, communication could be done to reach in-charge of the nearby facility of the residential area of clients. Sometimes the communication could be done to the district administration office incase there are difficulties in communication with doctor in-charge of the nearby facilities. The communication about defaulters could also be passed between C-HBC in residential areas when it is known that client have migrated to certain area. For example, at TUNAJALI headquarter, a list of C-HBC in different residential areas of different districts was maintained.

Other challenges faced in PMTCT/HIV tracing activities include clients’ using different names in the facility and community, using different names in different facilities and unwillingness of some clients to be associated with C-HBC or PLWHIV.

Later facility provider or C-HBC would provide feedback about the follow up activity. Clients could come and receive services and PMTCT registers updated. In some cases, local tracing information tools could also be updated with comments like deceased, very sick, unknown or refused services.

Defaulter tracing activities information and reports are used within the facility and with partners (e.g. TUNAJALI OR PLWHIV). In facility meetings, PMTCT/HIV defaulter tracing plans and activities are discussed. I observed in four CTC clinics, local tools for tracing defaulters and daily reports; one item was about number of clients with missed appointment. Lost to follow up status could also be indicated on patient folder and facility quarterly reports showed the clients’ number on lost to follow up status.

6. Analysis

This section provides analysis of the empirical findings by elaborating commonalities in defaulter tracing practices and then differences between programs and rural/urban context. Finally, a framework for defaulter tracing information system is presented by using human activity system framework.
6.1 Commonalities in Defaulter Tracing Practices

Part of both vaccination and PMTCT services is to trace attendance within the two programs. When a mother attends vaccination services, nurses would inquire from mother attendance of PMTCT and remind her to attend PMTCT services and similarly for PMTCT services. In some cases, nurses in vaccination/child health services would inform nurses in PMTCT about presence of PMTCT children so that they can be reminded to attend the service.

Defaulter tracing activities are challenged by logistic issues such as lack of transport, higher workload, follow up incentives, and lack of communication between tracers and clients about the time of visits. Default tracers might walk big distance to reach defaulter's houses even though the problem is magnified in rural context. Higher workload in health facilities is another barrier since nurses could not have time to generate defaulters list. Home visits were also challenging. It was possible that the provider would not find the client at home and this would require visiting the house more than once.

VHW are not paid employees and hence some are reluctant to perform follow up activities. For example, in two rural health facilities which had 14 and 11 hamlets and VHW respectively; only one VHW from each village was active in her roles as community link to the facility. C-HBCs also receive little incentives and in some cases it results into lack of cooperation between facilities and C-HBC.

There were also challenges arising from information systems design and implementation challenges. The first challenge arose from manual information system operating in health facilities where it was tedious to generate defaulter names (difficult to search) or wrong calculation (naming someone a defaulter while the date is not yet due). Second challenge was associated with data quality problem; information recording incompleteness. Nurses could fill patients' cards but not facility registers and since defaulter names were generated from facility registers wrong defaulter entries would be generated.

Logistic and information systems limitations made defaulter tracing activities to be performed in limited perspective; just in catchment area for vaccination or not all criteria for PMTCT services. For PMTCT services, tracing of breastfeeding mothers or parents receiving results were not done through mobile phones for the similar reasons (higher workload and tedious to search).

In general in RCH, defaulter tracing practices are mostly done in vaccination and PMTCT services while tracing activities are either not performed or done in very limited perspective in other areas such as underweight and stunted children; missed appointments for other children not in immunization schedule; nutritional supplement distribution; because of logistic and information systems challenges.

6.2 Differences between Urban and Rural Contexts

There are differences in defaulter tracing practices between urban and rural contexts. First, in urban facilities, defaulters tracing activities could be done by providers through home visit or local leaders while in rural settings VHW could mediate role of nurses through doing home visit or passing defaulter names to local leaders. Second difference is that community engagement approach is more likely to be performed in rural area because of its nature (few people who interact more frequently). Some local arrangements in rural area such as children clinics schedule organized streetwise enhances community engagement.

Third difference is that in rural settings less PMTCT clients have access to mobile phones than in urban settings (interviews and document analysis proved so). Hence mobile phone tracing is more likely to be performed in urban settings and more dependence on CHW in rural settings.

6.3 Differences between Vaccination and PMTCT Programs

There are also differences in defaulter tracing practices between vaccination and PMTCT health programs. First, PMTCT services involve multiple implementation partners and this facilitates defaulters tracing through mobile phones calling and structure and incentives to C-HBC. The impact is seen in information recording practices whereby there is recording of phone numbers and mobile phone follow up which is not part of the vaccination services.

Regarding defaulter criteria, PMTCT have many criteria (missing appointments, breastfeeding mothers, testing schedules and tracing if mothers have received the results, tracing linkage to HIV clinics when results are positive) than vaccination where by missing appointment is the concern.

However, PMTCT defaulter tracing activities is complicated by the nature of the program which demands continuum of care and in which privacy is main concern, while vaccination program is simple and therefore uses existing community leadership facilitates tracing activities. Privacy issue limits the involvement of CHW when the client is not willing. There were inventions of local tools in almost all facilities visited to facilitate PMTCT and HIV defaulter tracing activities compared to vaccination services. Social stigma related to HIV also limits mobile phone usage during defaulter tracing; for example clients could not agree to be traced through phone or would not answer the call when she knows that it is the provider calling.
There are many people involved in tracing activities in PMTCT which could be in different areas such as nurses, provider in other facilities, CHW, local leaders, PLWHIV, district administration and TUNAJALI. That is tracing activities can be expanded to other people and geographical areas in search for defaulters. This is not the case in vaccination.

6.4 Activity systems of Defaulter Tracing Systems

This section presents defaulter tracing system by using the activity theory framework. Activity theory framework is used for the purpose of elaborating on the components which the defaulter tracing system for both vaccination and PMTCT program consist of. The elaboration also compares the vaccination and PMTCT programs in rural and urban contexts. Table 1 shows vaccination and PMTCT defaulter tracing activity systems for rural and urban context.
<table>
<thead>
<tr>
<th>Object</th>
<th>Vaccination Rural</th>
<th>Vaccination Urban</th>
<th>PMTCT Rural</th>
<th>PMTCT Urban</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tracing defaulters</td>
<td>Prioritized with local government enforcement</td>
<td>Prioritized</td>
<td>More prioritized with donor support</td>
<td>More prioritized with donor support</td>
</tr>
<tr>
<td>Subjects</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Health providers</td>
<td>Nurses and health officers</td>
<td>Nurses and health officers</td>
<td>Nurses</td>
<td>Nurses</td>
</tr>
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<td>Community Health workers</td>
<td>Village health workers</td>
<td>Not in the organization structure</td>
<td>Community home-based care provider</td>
<td>Community home-based care provider</td>
</tr>
<tr>
<td>Local government</td>
<td>More involved</td>
<td>More involved</td>
<td>Limited involvement</td>
<td>Limited involvement</td>
</tr>
<tr>
<td>General Population</td>
<td>Catchment area</td>
<td>Likely from different parts of town</td>
<td>Likely from different health facilities</td>
<td>Likely from different health facilities</td>
</tr>
<tr>
<td>Mediating Tools</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Facility Registers and Patient cards</td>
<td>Children and RCH cards</td>
<td>Children and RCH cards</td>
<td>PMTCT register, and Local registers and RCH cards with PMTCT code</td>
<td>PMTCT register, and Local registers and RCH cards with PMTCT code</td>
</tr>
<tr>
<td>Defaulters’ list</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes with privacy concern</td>
<td>Yes with privacy concern</td>
</tr>
<tr>
<td>Local reports</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Phone ownership and access</td>
<td>Not recorded (not in use)</td>
<td>Not recorded (not in use)</td>
<td>Low</td>
<td>Higher</td>
</tr>
<tr>
<td>Community residents records</td>
<td>Used</td>
<td>Used</td>
<td>Limited Use</td>
<td>Limited Use</td>
</tr>
<tr>
<td>Rules and Procedures</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recording in patient cards and facility registers</td>
<td>Information recording incompleteness</td>
<td>Information recording incompleteness</td>
<td>Information recording incompleteness</td>
<td>Information recording incompleteness</td>
</tr>
<tr>
<td>Searching and compiling defaulters’ list</td>
<td>Missed appointments and Multiple program; tedious, could be erroneous</td>
<td>Missed appointments and Multiple program; tedious, could be erroneous</td>
<td>Many criteria and Multiple program, more tedious, could be erroneous</td>
<td>Many criteria and Multiple program, more tedious, could be erroneous</td>
</tr>
<tr>
<td>Community engagement within the facility</td>
<td>More used</td>
<td>Limited use</td>
<td>Limited use due to privacy concern</td>
<td>Limited use due to privacy concern</td>
</tr>
<tr>
<td>Communication to other facilities</td>
<td>Unlikely</td>
<td>Likely</td>
<td>Very Likely</td>
<td>Very Likely</td>
</tr>
<tr>
<td>Nurses communication for Multiple program tracing</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Mobile phones calls to clients</td>
<td>Not probable</td>
<td>Not probable</td>
<td>Likely ( due to HIV stigma)</td>
<td>Likely ( due to HIV stigma)</td>
</tr>
<tr>
<td>Communication to other facilities</td>
<td>Not probable</td>
<td>Likely</td>
<td>Likely</td>
<td>Likely</td>
</tr>
<tr>
<td>Social networks in the community</td>
<td>More Likely</td>
<td>Likely</td>
<td>Likely (related to PMTCT only)</td>
<td>Likely (related to PMTCT only)</td>
</tr>
<tr>
<td>Communication to other facilities within certain area</td>
<td>Probable</td>
<td>Not probable</td>
<td>Probable</td>
<td>Probable</td>
</tr>
<tr>
<td>Home visit</td>
<td>Possible</td>
<td>Possible, challenged with continuous migration</td>
<td>Possible with privacy concern</td>
<td>Possible with privacy concern</td>
</tr>
<tr>
<td>Feedback to health facility</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Division of Labor</td>
<td>Facility and community: Trace &amp; provide feedback to the facility</td>
<td>Yes</td>
<td>Yes with privacy concern</td>
<td>Yes with privacy concern</td>
</tr>
<tr>
<td>Community</td>
<td>Defaulting clients</td>
<td>Defaulting clients</td>
<td>Defaulting clients</td>
<td>Defaulting clients</td>
</tr>
</tbody>
</table>

Table 1: Vaccination and PMTCT Defaulter tracing activity system in rural and urban contexts
7. Discussion

7.1 Social-Cultural Mediation: Rural-Urban Contexts and type of the Program

This section discusses how socio-cultural issues are mediating on patient tracing activities. Activity theory laid down by Vygotsky (1978) point out that human action is mediated by technical and psychological tools. Defaulter tracing information system depends heavily on horizontal flow of information between health providers and clients or health providers and community members (VHW and local leaders). Both cases of PMTCT and vaccination shows how different approaches are used to trace defaulters; community engagement, communication between nurses in vaccination and PMTCT, use of community health workers, use of local government or extending communication to other facilities within and across districts and other community groups such as PLWHIV. Horizontal flow of information refers to transfer of data among actors and consumers at the same level of the health care system (Shrestha and Bodart, 2000). Different defaulter tracing approaches are within horizontal flow information category which had been neglected in HIS debates in developing countries.

Horizontal information flow is mediated by rural and urban contexts; nature of health service program; HIS design and implementation; and logistic challenges. Horizontal information flow is mediated by urban and rural contexts due to its influence on use of community resources or mobile phone access. For example, community resources (social relations, community health workers, community bylaws) are more available in rural than in urban. For example, community engagement which depicts flow of information between clients in the same neighborhood in community is more likely to work in rural contexts than in urban contexts. In PMTCT services clients’ mobile phone access is higher in urban than in rural contexts.

Type of the health program also mediates horizontal flow of information. For example, in vaccination services there is a freer flow of information than in PMTCT services due to privacy concern. Findings also show how donor/partners such as TUNAJALI programme are facilitating horizontal flow of information between clients and providers in PMTCT whereas such infrastructures were not available in vaccination services. However, vaccination services defaulter tracing uses existing community resources such as social relations to perform tracing.

Health information systems in developing countries are challenged by limited resources in both medical, fiscal and information systems. This study found so. Logistic challenges could be barriers to flow of information between health workers and clients; problems associated with higher workload, lack of transport, motivation for tracing defaulter and lack of communication between clients and provider about the time of home visit could be barriers in defaulter tracing systems.

Fraser et al. (2009) argues that there is lack of good information systems to support tracing of clients at risks. This study found so. Defaulter tracing information system is mediated by poor quality of existing information systems; both manual aspect and data quality problems limit flow of information between community and facility. There have been some critics for HIS in developing countries about the quality of data (correctness) from lower levels. Examples of critics include inaccurate data generated and reported from lower to higher levels (Rubona, 2001) and little or poor use of information (RHINO, 2001; Lungo, 2003; Sheikh, 2005; Nyella, 2007). Findings from this study corroborates with those studies. This study have shown the local use of information in facility and community levels through activities of tracing defaulter and also have shown the impact of poor quality of information in delivering service whereby clients could be termed defaulters while actually it was the problem of data recording incompleteness. The next section discusses local reports and how it enhances facility management and collaboration between facility and community in health service provision.

7.2 Information Flow within the Facility and With the Community

Shrestha and Bodart (2000) argue that properly designed information system will ensure that information needs are relevant at both higher and lower levels of the health sector of the particular country. Findings show presence of local reports which are used to facilitate health services provision (defaulter tracing) and facility management (defaulter tracing plans) and collaboration between facility and community (defaulter information to be discussed in community meetings).

Local reports can be termed short-long term reports because some aspect can be addressed in temporary manner while other aspect in long term manner. For example, the defaulters whose status is unknown after tracing activities will remain in need until the status is resolved. These reports are different from long term reports such as monthly reports, quarterly reports which in most cases remain as facility records and also sent upward and will be used for many years for planning and policy purpose.
8. Conclusion

HIS studies in developing countries have focused on information flow from the lower (facility) to the higher levels (district, region & ministry). Shretha and Bodart (2000) argue that better understanding of methods that enhance horizontal transmission mechanism is critical, given the increase of community actors. The paper provided an overview of defaulter tracing information system in maternal and child healthcare in a developing countries setting. Defaulter tracing information system use both facility based information systems and community based information systems and it involves multiplicity of people, relationships, information tools and uncertainties within and across health facilities and communities. This study aimed at describing horizontal information flow in health facilities and communities and it contributes to HIS in developing countries debates by showing importance of horizontal flow of information in the continuity of care. Defaulter tracing information system depends heavily on horizontal flow of information between facility and community. Defaulter tracing information system is also mediated by socio-cultural issues such as rural and urban contexts and nature of health service program. Defaulter tracing information systems is also influenced by HIS design and implementation, and logistic challenges.

This study might have design and implementation implications for researchers and developers of computer based patient care information systems in developing countries. With an increase use of computer based systems and mobile phone usage, how design and implementation of HIS in maternal and child healthcare can support defaulter tracing activities for maternal and child healthcare should be considered. The first step is to include clients’ mobile phone number recording practices in the design and implementation of health information systems so that communication between health providers and clients/ community health workers/ community leaders could be done through mobile phones. However, rural and urban context should be taken into consideration and limiting issues such as low phone access in rural should be combated with some mechanism for instance generating printable defaulter list which could be communicated to community health workers or leaders. Hence flow of information need not only to focus on client registered into health programs but also other people (local leaders, community health workers or any one) who are supporting defaulter tracing and delivery of care in general.

Design of defaulter tracing information systems need also to be aware that there could be different demands for different health programs and that in some cases clients need to be traced for attendances in multiple programs. This has implication for the design of patient forms/ registers and related reports in both manual and computerized forms: There should be features for showing comprehensive overview of clients’ attendance in both programs. Designers should also be aware that within the facilities, program performance (program summary attendance or defaults names) should be included in the design of computer based system which is in contrast to the current HIS design where the focus is on aggregate data. HIS design in developing countries needs to address such kind of reports. For example, some local information practices are done to facilitate these kind of reports such as local tools found in RCH and CTC to facilitate defaulter tracing practices. The availability of local reports would enhance communication and hence collaboration between facility and community and would enhance local facility management. The study might also have HIS implementation implications. To enhance information systems to support patient based care, the problem of data quality (information recording incompleteness) should be addressed. One approach could be to see how the community can be involved in improving quality of facility based information systems.

9. References


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