



Evaluation of Mathematics, ICT and Technology (EVALMIT) 2023–2024

Self-Assessment for Administrative Unit

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University of Oslo (UIO)
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1. Strategy, Resources and Organization

With a staff of more than 400 and close to 2,500 students, the UiO Department of Informatics (IFI) is a “powerhouse” for informatics teaching, training, and research in Northern Europe. It is the largest such unit in Norway and the one with the strongest international rankings. Around a comprehensive core in computer science, IFI interprets informatics in substantial breadth: from microelectronics, robotics, and signal processing to digital entrepreneurship, information systems, and participatory design. In 2023, IFI hosts five BSc and eight MSc study programmes. The proud history of the department includes the pioneering work of Ole-Johan Dahl and Kristen Nygaard, inventors of object-oriented programming (both) and the Scandinavian Model of participatory design (Nygaard). Both have received ACM A. M. Turing Awards and IEEE John von Neumann Medals (in 2001 and 2002, respectively), accomplishments that until today contribute to the international standing of the department. In 2023, IFI ranks #38 (third in Europe) in the Shanghai ranking for *computer science & engineering*, and #126–150 in the Times Higher Education ranking for *computer science*, up from ranks #63 and #201–250, respectively, in 2018.

1.1 Research Strategy

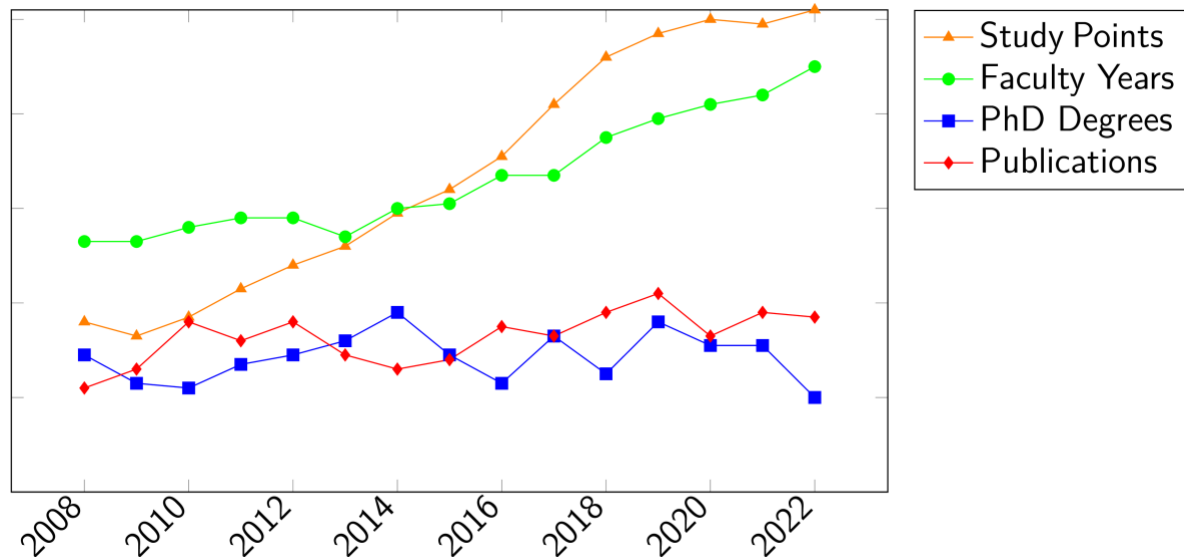
Throughout most of 2022, the department has conducted a comprehensive strategy process with broad involvement, combining “bottom-up” and “top-down” elements. The resulting [Strategic Plan](#) for the period 2023–26 provides a high-level “mission statement” for IFI (p. 1; see Table 1):

The Department of Informatics (IFI) at the University of Oslo (UiO) is a leading research-intensive informatics department in the Nordic region. IFI represents the field of informatics with considerable professional breadth and offers education and knowledge of high international quality. Informatics is a key sustainability discipline; IFI develops and offers knowledge, methods and technologies that contribute to digital and sustainable societal change. The department actively participates in funding schemes for both basic, long-term and thematic, applied research. We work systematically and in a long-term perspective with research quality and talent development. The department offers research-based teaching at the BSc and MSc levels, through a number of aligned study programmes, shorter programmes, as well as experience-based offers for life-long learning. IFI is both nationally and internationally attractive for doctoral candidates, postdoctoral fellows and other researchers. Recruitment of students and staff aims to ensure that the department reflects the diversity of the society at large to the greatest extent possible. The learning and work environment at the department is characterised by openness and respect; there is zero-tolerance for discrimination. The department practices trust-based management; provisions are made for transparency and efficient operation through, among other things, routine descriptions, delegated responsibilities and use of digital tools, with a focus on open standards. The department is a sought-after and reliable partner for other research and higher education organizations, as well as for Norwegian and international businesses.

IFI is one of nine departments at the UiO Faculty of Mathematics and Natural Sciences (the MN Faculty), in recent years accounting for close to 45% of teaching activity at the Faculty, and for around 30% of externally financed R&D. UiO and the MN Faculty in particular have strong traditions of high-quality, long-term, curiosity-driven research and, accordingly, of strong research-based education and doctoral training. UiO is widely recognized as the most research-intensive university in Norway, and this holds equally for the MN Faculty. IFI has been part of these traditions since the late 1960s, originally as a section at the Department of Mathematics, since 1977 as a department in its own right. While curiosity-driven research remains a defining characteristic of the department, IFI has gradually engaged more in applied research and industry collaboration over the past decade. Parallel

immense growth in teaching activities and increased external focus on “feeding” the ICT labor market and current societal demands present a challenging environment for sustaining and furthering core strengths in foundational research. Part of this “dilemma” is visualized in Figure 1: Between 2008 and 2022, faculty full-time equivalents (FTEs) at the department and ECTS study points have grown by 70% and 183%, respectively, meaning that teaching per FTE is greatly increased (if in no small part reflecting economies of scale). At the same time, staff growth has yet to reflect itself in quantitative indicators of scientific production (see Sections 1.4, 2.1, and 4.3 for more details on PhD training, and Section 2 *Production* on publications).

Figure 1. Schematic long-term view of key activity indicators (staff years include adjunct positions).



Since 2020, the department is organized in four thematic sections, which each represent broad scientific focus areas: (i) software design and development, (ii) distributed systems and security, (iii) machine learning and physical systems, and (iv) digitalization and information systems. These groupings reflect strategic prioritizations during the evaluation period, where each of the sections includes areas of focused investment in the past decade; please see Section 2.1 *Research Quality* for details. Research activities across sections comprise both theoretical and experimental approaches, as well as formal, quantitative, and qualitative methods. Recent development is grounded in consensus around four core values: (i) *sustainability in all activities*; (ii) *balance between research and education*; (iii) *quality of the learning and work environment*; and (iv) *equality, diversity, and inclusion*.

A key strategy element at UiO, the MN Faculty, and IFI is related to sustainability. The current strategy for the department centers around a thematic initiative dubbed *Green Informatics*, where “green” is to be understood as environmental sustainability, while “informatics” is interpreted broadly, besides data and software systems including e.g. electronic and physical devices, interdisciplinary perspectives on the use of information technology, digital innovation and entrepreneurship, etc. This initiative capitalizes on methods, technology, or processes that enable sustainable and digital transformation (the *twin transition*), for example solutions that support the *European Green Deal* or that can contribute to climate and environment-related societal tasks in the *Horizon Europe* research programme. Allocation of internal resources like seed or equipment funds and doctoral fellowships is guided by this focus area.

Key decision points in strategic prioritization are about resource allocations. Owing to both retirement and growth, IFI has made a large number of faculty appointments, including 26 new permanent positions since 2017. These have been defined and allocated to research groups

according to staffing plans that were directly informed by the strategies for the periods 2014–17 and 2019–21 (see Table 1). Related to these prioritizations is the use of internally funded doctoral and postdoctoral fellowships, which regularly are allocated to (i) support new faculty appointments, as well as to (ii) stimulate new activity in areas of strategic importance, (iii) reward outstanding work related to grant acquisition, and (iv) further core values of IFI, in particular improved gender balance.

Table 1: Most relevant strategic documents for the administrative unit.

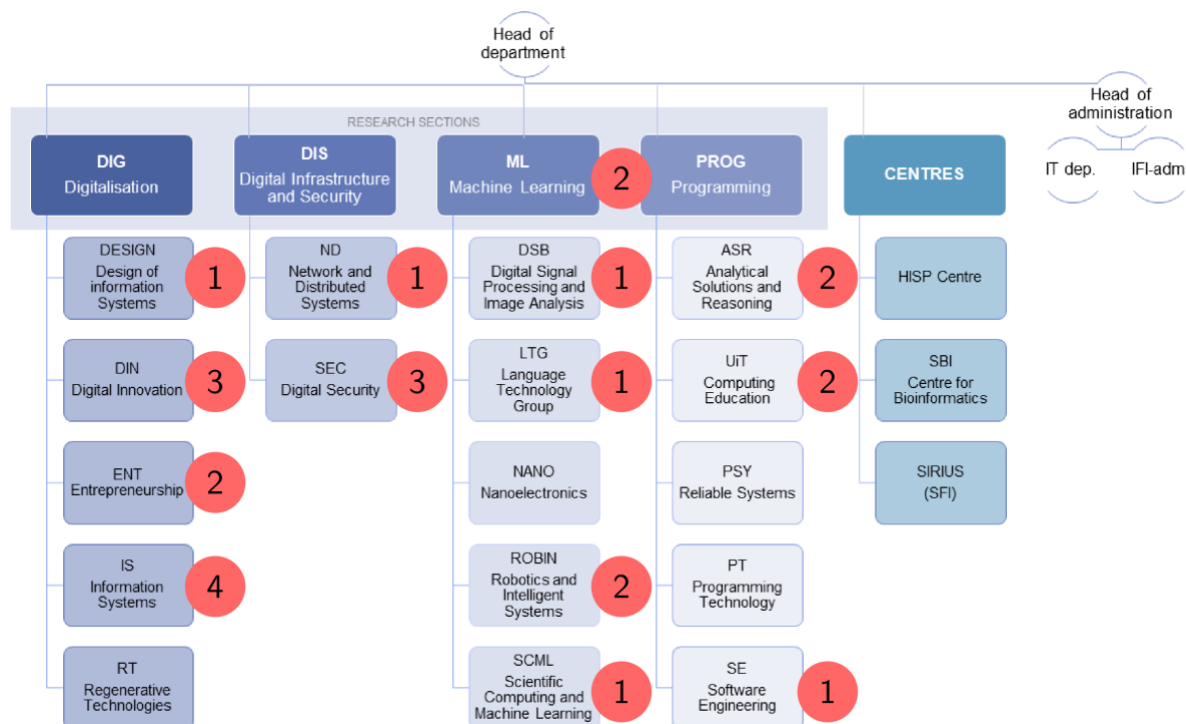
Research strategy		
No.	Title	Link
1	Department of Informatics, UiO: Strategic Plan 2023–2026	https://www.mn.uio.no/ifi/english/about/strategy/
2	Department of Informatics, UiO: Action Plan 2019–2021	https://www.mn.uio.no/ifi/english/about/strategy/2019–21.pdf
3	Department of Informatics, UiO: Strategic Plan 2014–2017	https://www.mn.uio.no/ifi/english/about/strategy/2014–17.pdf
4	Faculty of Mathematics and Natural Sciences, UiO: Science and Technology Towards 2030	https://www.mn.uio.no/english/about/strategy/mn_strategibrosjyre_engelsk_web.pdf
5	University of Oslo: Comprehensive Climate and Environmental Strategy, 2022–2030	https://www.uio.no/english/about/strategy/climate-and-environment/index.html
Outreach strategies		
No.	Title	Link
1	University of Oslo: Strategic Collaboration	https://www.uio.no/english/about/global/strategic-collaboration/
Open science policy		
No.	Title	Link
1	University of Oslo: Policies and Guidelines for Research Data Management (updated in 2022)	https://www.uio.no/english/for-employees/support/research/research-data-management/policies-guidelines.html
2	University of Oslo: Open Access Policy (updated in 2022)	https://www.ub.uio.no/english/writing-publishing/open-access/open-access-policy.html

1.2 Organization of Research

(A) Structure and Management The basic structural building blocks at IFI are 17 research groups, each comprising between 2 and 9 permanent faculty (5.3 on average, in 2023). All scientific staff is organizationally a member of one group, which serves as the most immediate frame of reference for collaboration around research and teaching, as well as for everyday social interactions. Two of the research groups – *Computing Education* (ITU) and *Regenerative Technologies* (RT) – were formed in 2020 and do not participate in EVALMIT, as their size for the time being remains limited to 2–3 faculty members. Figure 2 depicts the clustering of research groups into four thematic sections, which each represent key areas of competencies and strategic development at IFI. The section structure was first established in 2020, but is already showing positive effects, for example, providing

well-defined arenas for scientific (and social) activity across groups, and helping organize teaching and alignment with the 13 study programmes managed at IFI. The figure further shows growth in permanent staff since 2017, reflecting strategic prioritization; see Section 1.3 *Staff* below.

Figure 2: Research organization in groups, sections and centres, including new positions since 2017.



In addition to the four sections, there are three semi-autonomous centres hosted at the department. These are formally not part of EVALMIT. However, each centre is closely associated with at least one research group, such that faculty in the groups typically conduct much of their R&D activities in relation to the centre. There are some externally funded researchers at the centres, but a large part of their staff is dedicated to technical and administrative support. The Health Information Systems Programme (HISP) was established in 2021, to provide an organizational framework for software development, implementation, capacity building, and associated action research focussed on health information management in the Global South. This work has grown out of what are the current groups for *Information Systems* (IS) and *Digital Innovation* (DIN) over a period of about twenty years and has outstanding global uptake and visibility. The self-evaluation from the IS group provides more details. The Centre for Bioinformatics (CBI) is a joint initiative with the Departments for Biosciences and Pharmacy, the MN Faculty at large, the UiO Faculty for Medicine, and the UiO Life Sciences initiative. At IFI, the research group for *Scientific Computing and Machine Learning* (SCML; formerly *Biomedical Informatics*) has been closely involved with CBI since before it was formally established in 2018. Finally, the SIRIUS Centre for Scalable Data Access was an RCN-funded national centre for research-driven innovation (SFI), hosted at IFI, with its grant period of eight years wrapping up in 2023. The research groups for *Analytical Systems and Reasoning* (ASR) and *Reliable Systems* (PSY) have been behind SIRIUS, with involvement from the *Network and Distributed Systems* (ND) group and the *Language Technology Group* (LTG).

The ultimate decision making organ for IFI is the Department Board, which is elected by staff and students for periods of four years. For each such period, there is an independent election for Head of Department (HoD) and Deputy Head of Department (who currently serves as Head of Research), both elected by staff and students from among local faculty.

By delegation from the Board, the HoD has operative authority to appoint additional deputy heads (currently two Heads of Education), section and group managers, as well as various advisory councils, e.g. for teaching, doctoral training, Green Informatics, and diversity, equality, and inclusion (DEI). Such appointments are made in consultation with all stakeholder groups and often based on open nomination processes. Operative management is organized in three tiers, (i) weekly meetings of the management team, HoD, deputy heads, and the Head of Administration (HoA); (ii) biweekly meetings in what is called the management forum, extending the core team with the four section managers, the Head of Doctoral Training, and the administrative Head of Studies; (iii) larger gatherings of the management forum, group managers, and centre managers about three times per semester. Given the relatively recent creation of the four-pronged section structure, the department management has put much emphasis in the current period on developing (and documenting) structures and routines, as well as in building relations of trust.

(B) Synergies between Different Purposes The two central purposes at IFI are teaching and research, with outreach and innovation as two secondary pillars. Researcher training, particularly at the doctoral level, combines elements of teaching and research. Up-to-date and substantive research-oriented curriculum design is a critical synergy, as the department takes pride in its role as a flagship in providing research-based training. This is pursued through dedicated programme boards for each study programme (where aligned BSc and MSc programmes have a joint board), with scientific representatives from participating research groups and strong involvement of the study administration at IFI, as well as student and in some cases external representatives. Programme board managers, in turn, are organized in the department-wide teaching council, with a mandate for holistic management of the course and programme portfolio at IFI. Student involvement in research is furthered through a preponderance of “long” MSc projects, a total of 60 ECTS spread out over three semesters, often involving externally funded project staff in co-supervisory roles. Students select their MSc projects through an open digital marketplace, which incentivizes prospective supervisors to make their research specializations visible through their course offerings at the late BSc and early MSc levels. Finally, the department has recently established an additional arena for coordination between the different purposes, joint extended meetings between the management forum and teaching council, held twice per semester. This arena typically addresses one or two specific cross-cutting topics and is already showing promising results.

Realization of synergies between training and research, on the one hand, and outreach and innovation, on the other hand, is less systematically structured. A key element here is high societal demand for candidates with ICT training, where large volume at IFI over time has led to a broad network of alumni – problem owners, problem solvers, managers, or policy makers. This, arguably, is our most important societal impact. It is not uncommon for past graduates to resurface as contact points to external partners, e.g. through industrial PhD degrees, applied research collaboration, or joint innovation activities; see Sections 1.5 (B) *Grants* and 4.2 *Innovation* for details. To facilitate outreach and communication of knowledge, IFI has its own communications team (1.5 FTE), who among other things assist in media contacts, maintain a public database of scientific experts, offer training in popular science communication, and also take a central role in student recruitment to IFI.

1.3 Research Staff

The vast majority of staff at IFI is associated with the 15 participating research groups. Table 2 provides a breakdown by different types of position, including gender distribution (see Section 3 *Diversity and Equality* for further discussion) and proportions of temporary contracts. All regular faculty in Norway is appointed with tenure, i.e. there are no temporary positions in these groups. Doctoral and postdoctoral fellows, on the other hand are always hired on fixed-term contracts, and this also holds for the majority of appointments in what is called researcher positions (with or

without doctoral degree) and for adjunct appointments. This latter category comprises staff with a regular position outside UiO – e.g. another university, research institute, or company – who are appointed with up to 20% at UiO for renewable periods of 2–5 years. In addition to staff summarized in Table 2, who are associated with the groups participating in EVALMIT, there were an additional 12 scientific staff in the two research groups not participating due to small size. In terms of primarily technical and administrative staff not associated with a specific research group, there are some 50 in sum at the three centres, and 42 in the department administration and IT support division. Different types of positions have different allocations related to teaching and research; see Section 1.4 (B) *Research Time* below.

Table 2: Staff associated with participating research groups and gender distribution (October 2022).

	Position by category	No. of researchers	Share of women per category (%)	No. of temporary positions
No. of Personnel by position	Professor (1013)	41	17.1% (7)	0
	Associate Professor (1011)	36	33.3% (12)	0
	Senior Lecturer (1198)	6	16.7% (1)	0
	Lecturer (1009)	5	20% (1)	0
	Researcher (1108, 1109)	18	42% (3)	13
	Postdoctoral Fellow (1352)	29	27.6% (8)	29
	Doctoral Research Fellow (1017)	105	41.9% (44)	105
	Engineer (1085, 1181, 1088)	5	9% (0)	1
	Adjunct Professor (1013)	22	4.5% (1)	20
	Adjunct Associate Professor (1011)	42	19% (8)	42
	Adjunct Senior Lecturer (1198)	5	40% (2)	4
	Adjunct Lecturer (1009)	9	33.3% (3)	9

The period since around 2017 has been characterized by a large number of permanent faculty appointments, owing to (i) many retirement-related replacements, (ii) a few resignations, and (iii) 26 additional faculty positions (as indicated in Figure 2, of which three remain to be filled), most associate professors. This development means that more than one third of current faculty has started in the past few years, leading to a “fresh” generation of associate professors who still are in the process of establishing themselves and to fully become part of the department moving forward.

1.4 Research Career Opportunities

(A) Structures and Practices Support for research career development is distributed between the department and MN Faculty. Examples of services organized at the Faculty level include: (i) on-line and hybrid career support programmes – covering career planning, time management, publishing strategies, project management, networking, etc. – for doctoral and postdoctoral fellows, over 8 weeks or 7 months, respectively; (ii) annual, two-day PhD programme seminars for new fellows; (iii) general grant application guidance and (iv) more targeted seminars and individual coaching and proposal feedback for e.g. ERC applicants; (v) a biweekly newsletter for early-career researchers, with relevant generic, social, and scientific information; (vi) an annual career week with workshops and sessions on generic skills, as well as meeting arenas with representatives from research institutes and industry; (vii) professional personal counselling on all aspects of the early career experience, with special emphasis on psychological health.

At the department level, both doctoral and postdoctoral fellows initially set up a development plan jointly with their supervisor(s), and the department facilitates annual follow-up and a more

structured mid-term review for doctoral fellows. All new doctoral candidates have a comprehensive, individual information meeting with a PhD adviser and their principal supervisor when they start; to further align expectations, a mandatory induction conversation between the candidate and principal supervisor forms part of the admission process. All doctoral fellows and base-funded postdoctoral fellows employed at the department are allocated a personal budget for operating expenses, currently 30 kNOK per year. Close to half of this group, based on candidate preferences and department needs, also are offered contract extensions of 6–12 months related to career-enhancing duties, in order to improve their SoTL (scholarship of teaching and learning) qualifications.

Doctoral and postdoctoral training is obviously an essential part of research career development at IFI. In 2022, an international panel assessed the PhD programme at the MN Faculty and concluded that the programme is well-functioning and well-managed. IFI is a vital part of this accomplishment. The department management meet annually with the Faculty Dean of Education, to review the quality of its researcher education and ongoing initiatives to improve it.

Regarding other staff, new permanent faculty are typically offered a “starting package”, i.e. a fully funded doctoral fellowship, with a profile of their choice. Every research group manages a shared local budget for operating expenses, with an allocation of 40 kNOK per year per permanent staff member. Also, the department covers the cost of Norwegian language courses for all employees with a contract duration of at least two years.

(B) Distribution of Research Time Professors and associate professors nominally have 45% research time, 45% teaching, and 10% administration. For lecturers the corresponding proportions are 15%, 75%, and 10%. Doctoral and postdoctoral fellows have at least three and two years, respectively, in “pure” research time, and can have between 10%–25% additional time allocated to career-enhancing duties, typically teaching contributions and (co-)supervision. For the few technical and administrative staff directly associated with a specific research group, it is assumed that these positions support research and teaching activities with about equal shares. There is no hourly accounting at the level of individual employees. Instead, the department compiles annual teaching surveys at the level of research groups, accounting for both available capacity and actual activity based on pre-defined average “norms”. This scheme strikes a good balance between local autonomy and resource management, affording research groups great flexibility in shifting around allocations among group members and over time.

All permanent scientific staff, including lecturers, can on application be granted research and educational leave of one year or half a year, after six or three years of service, respectively. IFI seeks to accommodate sabbatical applications to the largest degree possible. Typically, the local research group is expected to make internal arrangements, which often is facilitated through (re-)allocation of work duties of (post-)doctoral fellows or adjunct positions.

(C) Research Mobility When faculty apply for a sabbatical, the department (by application) provides a mobility stipend to support the stay abroad, e.g. offset extra costs related to housing, transport, and more. For young researchers there are several funding possibilities for a stay abroad, e.g. project funds, the Kristine Bonnevie scholarship from the MN Faculty, or dedicated external mobility grants. These schemes can support research stays abroad of several months to a year and capitalize on postdoctoral and doctoral fellows as their primary target groups. Supervisors commonly encourage mobility and assist in making connections, e.g. by placing candidates to spend a semester with an international collaborator. Shorter stays abroad and hosting of guest researchers at IFI frequently occur as individual initiatives, often supported by external funding. Essentially, the vast majority of researchers at IFI have good access to international collaboration networks.

1.5 Research Funding

(A) Funding Sources The two main sources of funding to the department are (i) base and (ii) external funding. Base funding comes to the university from the Ministry of Education and Research and is sub-allocated via the MN Faculty according to an internal, partly pro-rata and partly result-oriented model. In a nutshell, annual base funding to IFI reflects five-year averages of indicators such as study credit and grades “production” and incentives related to grant acquisition. Primary sources for external funding are the Research Council of Norway (RCN) and EU framework programmes, where for the past decade hefty incentive schemes have been tied to EU grants. Secondary funding sources include regional health authorities, the Norwegian Cancer Society, some direct industry collaboration, and international foundations. An important difference from other Nordic countries is that Norway lacks private funding on the scale of e.g. the Wallenberg or Carlsberg foundations in Sweden and Denmark, respectively. Also, industry funding of university research is less common than in our neighbouring countries.

For the department at large, including its three centres, both base funding and external funding to IFI have grown substantially in the period 2018–22, owing to increased student numbers and growth in external grants. However, it is difficult to analyze this growth in depth, seeing as (i) UiO in mid-2021 switched to a new accounting model and system, and (ii) the HISP Centre has seen an exceptional development during and after the global pandemic. Furthermore, (iii) much of the HISP income constitutes non-research funding from international bodies like the CDC, the GAVI vaccine alliance, and the Global Fund, which primarily is not expended directly at UiO, but rather sub-allocated to world-wide contractors and non-governmental organizations in the Global South. For accounting year 2022, and excluding HISP and the Centre for Bioinformatics, the total budget for IFI comprised some 334 mNOK, of which a little more than 72% were salary costs (not including hourly salaries to student assistants, which sum to around 10 mNOK per year). Of these, in turn, 22% correspond to external funding. Using the distributions of research vs. teaching tasks sketched in Section 1.4 (B) *Research Time* above, base-funded R&D accounts for around 88 mNOK in salary costs, or about 47% of total base-funded salaries. The vast majority of external grants by nature support R&D activity, such that the overall percentage of R&D salary costs is around 57%. About 15% of base-funded salaries correspond to technical and administrative support (11% of all salary costs), but a good part of this is recovered through overhead on external funding.

While the financial situation of the department has been strong for the past several years, with much growth fuelled by increased teaching activity, the current period has been characterized by uncertainty and tightening budgets since 2022. This development reflects deteriorating conditions for the Norwegian university sector at large, and arguably for the research-intensive UiO and MN Faculty in particular. Owing among other factors to budget reductions, undercompensated inflation, shifting student demographics, and the reversal of additional teaching and training capacity allocated during the pandemic, the MN Faculty has seen a net decline in base funding for three years in a row, with index-adjusted total funding for 2023 almost 10% below the 2018 level. The national government has instructed universities to prioritize ICT in internal (re)allocations, but so far this appears difficult to implement in the meritocratic UiO system. For these reasons, two planned faculty recruitments have been frozen throughout 2023, the pool of base-funded (post-)doctoral fellowships at IFI much reduced, and allocations of career-enhancing work duties to fellows slashed by half.

(B) Competitive National and International Grants The department has steadily grown in acquiring externally funded national and international grants. In the period 2018–2022, IFI had around 49 ongoing projects funded by the Research Council of Norway (RCN) and 24 from the European Commission. From RCN, the department has succeeded in several highly competitive calls:

Researcher Projects These grants support scientific renewal and development in research that can help advance the international research front. The funding is for researchers who have demonstrated the ability to conduct research of high scientific quality. From 2018 to 2022, the department had some 13 projects where our research staff was the principal investigator (coordinator). These projects involve all sections and 9 of the research groups.

Young Research Talents This highly competitive scheme allows talented young researchers under 40 to pursue their ideas and lead research projects without thematic limitations. This funding is for researchers in early careers, typically 2–7 years after receiving the doctorate, who must have demonstrated the potential to conduct research of high scientific quality. The department had two such young talent grants in the period 2018–2022.

Ground-Breaking Large Research Projects This funding allows outstanding research environments to develop to become international leaders in their fields of expertise. The projects receive 12–25 mNOK in support for up to six years. Under these schemes (*Fellesløft III* and *IV*), applications are evaluated by the same RCN expert panels as regular applications to the ground-breaking research programme. But these grants are co-funded by the universities, such that they ultimately participate in selecting projects from among the highest-ranked applications in the RCN evaluation. IFI has succeeded as coordinator with two such projects, in 2018 and 2022, respectively.

ICT Lighthouse Projects These are larger, challenge-driven collaborative projects within health, care, and welfare topics. IFI had significant partnership in three such projects (DoMore, INTROMAT, BigMed), with involvement of four of the research groups.

SFF, SFI, and Other Centres The centre schemes for research excellence (SFF) and research-based innovation (SFI) are the most prestigious national grants. These centres work with ambitious ideas and complex issues where collaboration and long-term research efforts are important. SFFs conduct foundational long-term research and receive funding for a total of ten years. IFI participates in one ongoing SFF (RITMO), and since 2023 as one of four co-equal partners in a new one (Integreat). SFIs facilitate research-based innovation and value creation. The aim is to strengthen the ability to innovate in the Norwegian business community and to promote sound and long-term business-oriented research with internationally recognized quality. SFI receive funding for a maximum of eight years. The department has coordinated one SFI (SIRIUS) and participates in five (C3, CIUS, Visual Intelligence, Media Futures, NorwAI). No less than six research groups contribute to these centres. Finally, IFI is also a partner in the eight-year business and society-oriented research centre INTRANSIT.

International Partnerships for Excellent Education, Research, and Innovation This funding scheme is a follow-up to the Norwegian government's Long-Term Plan for Research and Higher Education and SFF efforts to develop more world-leading academic environments in Norway (a central measure in the Panorama strategy). The department has coordinated two (COINMAC and COINMAC2) and partnered three such network projects. Two sections are actively involved in these projects.

Societal Relevance and Industrial Cooperation Industrial PhD projects enable concrete research and development results that enhance companies' core activity, products, and services. In these projects, company employees receive researcher training with specialized expertise related to the company's needs and challenges. The department hosted at least nine industrial PhDs during 2018–2022, from Petroleum Geo-Services, Kongsberg Maritime, Equanostic AS, FFI, Omnivision, Sony, RailCOMPLETE AS, ODI Medical AS, and Domos Labs.

Innovation Projects for the Industrial Sector This funding instrument grants business-led innovation projects that extensively use research and development. The department has participated in at least six such projects since 2018.

IFI has enjoyed decent success in the *EU Framework Programmes*, particularly within collaborative projects, e.g. H2020 Industrial Leadership and HEU Pillar 2. We succeeded in several collaborative calls within the Horizon 2020 and Horizon Europe Work Programmes with at least 19 projects, of which three are coordinated by the department (3D-Muse, MELODIC, and MORPHEMIC). All sections and nine of the 17 research groups had active EU projects since 2018. In terms of EU excellence schemes, IFI participates in one MSCA innovative training network (REMARO), has received two MSCA postdoctoral fellowships, and has two MSCA RISE recipients.

Table 3: R&D funding per type per source, annual averages for period 2018–22

Share of basic grant (<i>grunnbevilgning</i>) used for R&D (kNOK)	
Ministry of Education and Research	83,393
National grants (<i>bidragsinntekter</i>) (kNOK)	
From the ministries and underlying directorates	
From industry	1,692
From public sector	822
From The Research Council of Norway	53,025
Other national grants	4,711
Total National grants	60,250
National contract research (<i>oppdragsinntekter</i>) (kNOK)	
From the ministries and underlying directorates	
From industry	340
From public sector	
Other national contract research	4,252
Total contract research	4,592
International grants (kNOK)	
From the European Union	9,515
From industry	
Other international grants	3,193
Total international grants	12,708
Total all R&D budget items (except basic grant)	77,549

1.6 Collaboration

The department policy toward national and international collaboration is based on the policies and strategies developed and adopted for UiO at large. The department actively participates in all funding schemes where our field is represented, i.e. basic, long-term, thematic, and applied research. The department regularly collaborates with several of the world's most high-ranked universities and other research institutions in addition to collaborations with the private sector, particularly the private IT sector, public sectors, and niche sectors in security and defence, health, space, agriculture, and more

At IFI, the collaboration in research is often one of mutual interests and shared goals between the department and our partners. We and our partners participate in projects on equal terms. The projects span from basic research to applied research, from collaboration grants to commissioned projects, and of course from national to international funding sources. It is rare that we participate in

projects as a third party or sub-contractor. Long-term collaboration with some of our more important partners are formalized through mutually signed agreements on the department or faculty level.

At IFI, the Department Board approves and adopts the long-term strategy plans, most recently the ones for 2019–2021 and 2023–2026 (see Table 1 above). Our long-term focus on quality and relevance in research has led to favorable results. The department has had a steady increase in the number of grant applications submitted, as well as in the number of funded projects over time. We continue to expand our collaborations internationally, e.g. forming new partnerships, cooperatives, and consortiums. In recent years, we have nearly doubled the number of submitted proposals, primarily toward the Horizon Europe framework program, but we have also expanded our network and collaborations with institutions in South America, Africa, and Asia.

The department recognizes that diversity in research collaborations is essential for its research and the credibility, relevance, creativity, and innovation of its R&D results. We are confident that much of our research would not be possible without a diverse composition of partnerships. Our projects have international, interdisciplinary, and cross-sectorial partner compositions. IFI highly values research collaborations across sectors, geography, and disciplines. These have led to a higher number of academic outputs and with better quality, thereby supporting the overarching goal of addressing relevant societal challenges.

(A) National Collaborations As a large and broad department, IFI has collaborations with relevant research units at all the other universities in Norway. Table 4a below describes some of our most important national collaborations with institutions outside of the university sector.

Table 4a. Main national collaborative constellations with the administrative unit

Collaboration with national institutions - 1	
Name of main collaboration or collaborative project with the admin unit	Gemini centres, adjunct appointments, various research groups
Name of partner institution(s)	SINTEF
Sector of partner	Research Institute
Impacts and relevance of the collaboration	IFI has extensive collaboration with SINTEF in terms of hundreds of joint publications (co-authors from both institutions), many research projects where both institutions are partners, many PhD students with supervisors from both SINTEF and IFI, and many cases where SINTEF researchers have an adjunct position at IFI, and vice versa. One of the many arenas of collaboration is the Gemini Centre venue, which is “a model for strategic cooperation between research groups at NTNU, SINTEF, University of Oslo, St. Olav’s Hospital and NTNU Social Research”. Among the projects under this umbrella are the <i>Gemini Centre on IoT</i>, <i>Gemini Centre on Systems Development</i>, <i>Gemini Center on User Experience Design</i>, and Norwegian Gemini Center for Software Engineering.
Collaboration with national institutions – 2	

Name of main collaboration or collaborative project with the admin unit	Various research groups
Name of partner	Norwegian Computing Center (NR)
Sector of partner	Research Institute
Impacts and relevance of the collaboration	IFI and NR have a long history of cooperation in several fields. IFI research groups collaborating with NR include <i>Digital Signal Processing and Image Analysis</i> (DSB), <i>Information Systems</i> (IS), the <i>Language Technology Group</i> (LTG), <i>Networks and Distributed Systems</i> (ND), <i>Digital Security</i> (SEC), and <i>Robotics and Intelligent Systems</i> (ROBIN). Researchers at NR have adjunct associate positions at IFI, and participate as co-supervisors for PhD students and as examiners and evaluators at IFI courses. In addition, NR and IFI are both research partners in the SFIs Visual Intelligence and NorwAI, and the new SFF Integreat.
Collaboration with national institutions – 3	
Name of main collaboration or collaborative project with the admin unit	Various research groups
Name of partner	Simula Research Laboratory (Simula)
Sector of partner	Research Institute
Impacts and relevance of the collaboration	When Simula was founded back in 2002, the three initial research groups being established at Simula were recruited from IFI. Since then, there have been close ties between the two institutions, where the collaboration has materialized into many joint RCN, EU, and innovation projects, resulting in many co-publications. Another important area of collaboration is supervision of PhD and MSc at IFI. Collaboration with Simula includes the SUURPh program with the University of California, San Diego (see below). Simula has also been a partner of the SIRIUS SFI at the department.
Collaboration with national institutions – 4	
Name of main collaboration or collaborative project with the admin unit	Various research groups
Name of partner	South-Eastern Norway Regional Health Authority
Sector of partner	Health sector (public)

Impacts and relevance of the collaboration	The collaboration with the South-Eastern Norway Regional Health Authority includes research activities on areas of joint interest and relevance (e.g. digital strategy, security and enterprise architecture), joint positions, collaboration around teaching and student projects, and collaboration around innovation initiatives. IFI has collaborations both with the Division for Technology and e-health but also individual hospitals, such as Oslo University Hospital (see below), Akershus University Hospital, Østfold Hospital, and Sunnaas Hospital. In addition, several large and small projects include both partners, such as the SFI C3; two of three RCN Lighthouse Project in 2016: BigMed (which included IBM, DNV, DIPS, Karolinska Institutet, Kreftforeningen); DoMore (which included University of Oxford, UCL, Oslo Cancer Cluster, DIPS); the FIGI project; and many others.
Collaboration with national institutions – 5	
Name of main collaboration or collaborative project with the admin unit	Various research groups
Name of partner	Oslo University Hospital (OUS)
Sector of partner	Health sector (public)
Impacts and relevance of the collaboration	IFI and OUS has had extensive collaboration over many years and involving several research groups at IFI. Several sectors of OUS have been involved, most notably cancer medicine (Dept. of Cancer Genetics, Dept. of Cancer Immunology, Dept. of Tumor Biology and Dept of Oncology), laboratory medicine (Dept of Microbiology), informatics (Institute for Cancer Genetics and Informatics) and Division of Technology and Innovation. These collaborations have led to joint participation in RCN Centres of Excellence (e.g. Centre for Molecular Biology and Neuroscience, Centre for Cancer Biomedicine), KG Jebsen Centres (Centre for Breast Cancer Research, and Coeliac Disease Research Centre), an RCN Lighthouse Project (DoMore!), many other shared research projects, extensive collaboration in PhD and postdoc supervision, and several hundred shared publications. These collaborations have had a significant impact on the direction of research in some IFI research groups (e.g. SCML, ROBIN and DSB) and have been important to OUS. IFI regularly participates in conducting clinical trials as co-PIs or statistics and bioinformatics consultants, on tumour boards, and in research strategy meetings.
Collaboration with national institutions – 6	
Name of main collaboration or collaborative project with the admin unit	Various research groups

Name of partner	Norwegian Defence Research Establishment (FFI)
Sector of partner	Research institute
Impacts and relevance of the collaboration	The department has for decades had close collaboration with FFI around teaching, student projects, PhD supervision, research projects, and innovation initiatives. Several researchers at FFI have adjunct positions at IFI and vice versa. Research areas of joint interest and relevance include security, robotics, signal processing, image analysis, hardware design, communication, and space science.
Collaboration with national institutions – 7	
Name of main collaboration or collaborative project with the admin unit	Oslo Analytics, RCN research project coordinated by the Digital Security (SEC) group
Name of partner	Norwegian National Security Authority (NSM)
Sector of partner	Governmental agency
Impacts and relevance of the collaboration	NSM was part of Oslo Analytics during 2016–2020. NSM acted as work package lead for WP-E: Experiments and Validation. The contribution of NSM was to validate Oslo Analytics prototypes within the NSM strategic framework for incident detection and management. The strategic collaboration with NSM continues within the current JCOP project funded the Connecting Europe Facility (CEF) program.
Collaboration with national institutions – 8	
Name of main collaboration or collaborative project with the admin unit	SIRIUS SFI and EU projects Optique, BYTE, and REMARO
Name of partner	DNV (previously DNVGL)
Sector of partner	Private sector
Impacts and relevance of the collaboration	Collaborating in particular with the <i>Analytical Solutions and Reasoning</i> (ASR) and the <i>Reliable Systems</i> (PSY) groups, DNV has been a partner in the EU projects Optique, BYTE, and REMARO, as well as the SIRIUS SFI. In all cases they had a mediating role, closely following and participating in research, but with an intimate knowledge of the industrial application domains involved.
Collaboration with national institutions – 9	

Name of main collaboration or collaborative project with the admin unit	SIRIUS SFI
Name of partner	Equinor ASA, formerly Statoil and StatoilHydro
Sector of partner	Energy sector (private)
Impacts and relevance of the collaboration	Equinor is a Norwegian state-owned multinational energy company, and the ninth largest oil company in the world. Equinor has been the main commercial partner in the SIRIUS SFI, where collaborative activities involving also Simula (see above) have resulted in particularly two import impact cases: <i>Reservoir simulation:</i> Research on advancing the understanding of the subsurface has contributed to both a new modelling methodology that quantifies heterogeneity and contention in MPI-based reservoir simulations and implementation of this concept in the OPM (Open Porous Media) open-source framework. This has put Equinor in a position to achieve more efficient and faster reservoir simulations, which will have a tremendous impact on their reservoir “business”, including planning the storage of CO₂ in depleted reservoirs. <i>Semantic asset modelling:</i> Research on the structure of facility asset information, its creation and exchange through the value chain of the industry, and the application of logic and semantic web technology to information modelling, has contributed to a family of new information modelling languages that enable facility assets to be documented as scalable knowledge graphs. The languages are in use in several companies, a DNV Recommended Practice document is being published, and a process for ISO standardisation has been initiated.

(B) International Collaborations

Table 4b. The main international collaborative constellations with the administrative unit

Collaboration with international institutions – 1	
Name of main collaboration or collaborative project with the admin unit	The HISP Center and the <i>Information Systems</i> (IS) research group
Name of partner	World Health Organization (WHO)
Sector of partner	United Nations Agencies
Impacts and relevance of the collaboration	As a WHO Collaborating Centre, IS partners with WHO and its Member States to strengthen health information systems implementations and data use at the country level. To date, 64 primarily low- and middle-income countries have installed

	standards-based metadata packages from the WHO DHIS2 toolkit with support from partners, moving towards integrated national health data platforms that serve data analysis and data use at all levels of public health services, based on WHO recommended data standards. Emerging areas of collaboration include promoting the uptake of global data standards like ICD-11, research-based expansion of DHIS2 offerings for anti-microbial resistance surveillance, and improving data harmonization and exchange mechanisms between country systems and regional/global data platforms.
Collaboration with international institutions - 2	
Name of main collaboration or collaborative project with the admin unit	SIRIUS (SFI) and Optique EU project
Name of partner	University of Oxford (UK)
Sector of partner	University
Impacts and relevance of the collaboration	The interaction with the group of Ian Horrocks in Oxford has been crucial for attracting and realising the ambitions of Optique and SIRIUS, involving numerous research visits and adjunct positions. Collaboration with the University of Oxford as more established within the research field, has accelerated the work in the research groups involved in the projects, and all parties involved in the collaboration have benefitted from the access to and understanding of relevant application domains made possible by a long-term relationship between the <i>Analytical Solutions and Reasoning</i> (ASR) and Reliable Systems (PSY) groups and in particular Norwegian industry partners.
Collaboration with international institutions - 3	
Name of main collaboration or collaborative project with the admin unit	SUURPh (<u>S</u> imula <u>U</u> iO <u>U</u> CSd <u>R</u> esearch <u>P</u> hD Training)
Name of partner institution(s)	University of California (USA), San Diego (UCSD)
Sector of partner	University
Impacts and relevance of the collaboration	The SUURPh program is a joint PhD initiative by Simula, the University of Oslo (UiO), and the University of California at San Diego (UCSD), financially supported by the Norwegian Ministry of Research and Education. It aims to foster interdisciplinary research within computational biology and medicine including electrophysiology, neuroscience, cardiac mechanics, and the application of machine learning to biological processes. The scheme is designed to offer PhD candidates in Norway the

	opportunity to train internationally, while also enhancing collaborative efforts among researchers at Simula, UiO, and UCSD. In the period 2012-2022, the collaboration resulted in, among others, seven candidates defending their PhD thesis at the department. SUURPh also organize SSCP, the annual Summer School in Computational Physiology, where students spend 2 weeks of formal lectures and project work in June in Oslo, followed by 1.5 week of workshops, joint project work, and a final presentation in August at UCSD. The school has 10-year anniversary this summer.
Collaboration with international institutions - 4	
Name of main collaboration or collaborative project with the admin unit	The <i>Networks and Distributed Systems</i> (ND) research group
Name of partner	Internet Engineering Task Force (IETF) Internet Research Task Force (IRTF)
Sector of partner	Standardisation body / Internet Society
Impacts and relevance of the collaboration	The IETF is the international standardisation body for Internet protocols, while IRTF is its research arm. A decade-spanning collaboration involving several permanent and temporary staff has given IFI a position to transfer our research into standards, and through various projects, to ensure uptake in major operating systems. This work has been supported by projects such as RITE (EU), NEAT (EU), and OCARINA (RCN).
Collaboration with international institutions - 5	
Name of main collaboration or collaborative project with the admin unit	The <i>Nanoelectronics</i> (NANO) research group
Name of partner	Imperial College London (UK), Department of Electrical and Electronic Engineering
Sector of partner	University
Impacts and relevance of the collaboration	The NANO group has had a long-standing collaboration with Imperial College for close to 30 years involving common projects, exchange of researchers and co-publications. The research has been focused on biomedical circuits and systems. The collaborating group at Imperial is world leading on biomedical systems including implants where demands for energy efficient circuits are critical. Examples of research collaborations have been within data-converters where concepts developed at the NANO group has been adopted and integrated in larger systems.

	The collaboration also led to establishing the IEEE Biomedical Circuits and Systems Conference in 2004, currently the main event for the BioCAS research field. In recent years the collaboration has focused more on using UWB radar technology originating from the NANO group for biomedical applications and in particular within the framework of the UK Dementia Research Institute funding a research center where NANO radar technology is among the core sensors used to monitor elderly people with purpose of increasing quality-of-life.
Collaboration with international institutions - 6	
Name of main collaboration or collaborative project with the admin unit	The <i>Digital Innovation</i> (DIN) research group
Name of partner	University of Edinburgh (UK), Institute for the Study of Science and Technology (ISSTI)
Sector of partner	University
Impacts and relevance of the collaboration	DIN has had a collaboration with the ISSTI for more than 20 years, involving common projects, seminar/workshop activities and co-publications. The focus of the collaboration has been issues and challenges related to the development and evolution of large scale and complex information systems and infrastructures, in particular related to the health care sector. The Digital innovation group and ISSTI has been the core of the community organizing the bi-annual Innovations in Information Infrastructure (III) workshops. The collaboration also included a joint EU project 2010 – 2014 focusing on the development of mobile communication standards in EU and China, and a book on e-health together with other partners from the III network (Aanestad et al 2017).
Collaboration with international institutions - 7	
Name of main collaboration or collaborative project with the admin unit	The <i>Scientific Computing and Machine Learning</i> (SCML) research group
Name of partner	Oregon Health & Science University (USA), Knight Cancer Institute (OHSU) / The University of Texas (USA), MD Anderson Cancer Center (UT)
Sector of partner	University
Impacts and relevance of the collaboration	The SCML group has over the last decade had an active collaboration with professor Gordon Mills' group at Knight Cancer Institute (until recently affiliated with MD Anderson Cancer Center), involving shared PhD and postdoc supervision, co-publications and a patent application. The collaboration also

	involves the Institute of Cancer Research at Oslo University Hospital (see above). The focus of the collaboration has been the development of a protein biomarker that can predict from a needle biopsy taken before treatment whether a cancer patient will respond to treatment with bevacizumab. Our contribution to the collaboration has been to lead the activity of developing, refining and validating the machine learning based predictor. Originally developed for predicting treatment benefit in breast cancer, the utility of the biomarker in other cancer types (including ovarian cancer and colon cancer) is currently being investigated and with promising initial results. The importance of such a biomarker is high, since it helps to determine which patients should receive the drug and which patients should receive other treatments.
Collaboration with international institutions - 8	
Name of main collaboration or collaborative project with the admin unit	The <i>Robotics and Intelligent Systems</i> (ROBIN) research group
Name of partner	Federal University of Rio Grande Do Sul (Brazil), Institute of Informatics (UFRGS)
Sector of partner	University
Impacts and relevance of the collaboration	The ROBIN group has since 2017 had an active collaboration with Federal University of Rio Grande do Sul (UFRGS), funded by several RCN networking projects, focusing on intelligent machines represented by robots and AI. The collaboration involves in particular short-term and long-term reciprocal mobility stays by staff and students for collaboration in research, as well as guest lectures courses at both institutions. So far, there has been two faculty staff outgoing from UiO and four incoming from UFRGS. There has also been three outgoing and six incoming master and PhD students, mostly for 10 months, all contributing with research during their exchange.
Collaboration with international institutions - 9	
Name of main collaboration or collaborative project with the admin unit	Digital equity in AMR policy and practice (EquityAMR), a project funded by RCN
Name of partner	Post Graduate Institute of Medical and Education Research (Chandigarh, India)
Sector of partner/institution(s)/sectors involved	University

Impacts and relevance of the collaboration	The collaboration with Post Graduate Institute of Medical and Education Research spans two areas: (i) strengthening antimicrobial resistance (AMR) diagnostic facilities in sub-district levels, and improving visibility of infection patterns through digitization; and (ii) Analysing and enabling the processes of integrating data on AMR surveillance with policy making processes within hospitals to develop data driven locally relevant antibiotics stewardship policies. This work is in its fourth year and significant progress has been made on data collection and analysis. A number of publications has been developed and more are in progress.
Collaboration with international institutions - 10	
Name of main collaboration or collaborative project with the admin unit	The <i>Reliable Systems</i> (PSY) research group
Name of partner	University of Illinois at Urbana-Champaign (USA), Computer Science Department and Center for Assured Cloud Computing
Sector of partner	University
Impacts and relevance of the collaboration	PSY has had a collaboration with The University of Illinois at Urbana-Champaign (UIUC) for more than 20 years, involving reciprocal mobility stays for staff and PhD students, as well as co-publications. The CS department at UIUC is one of the leading computer science departments in the world. In particular, the collaboration has resulted in significant knowledge transfer; for example, the state-of-the-art modeling language and analysis tool Maude developed at UIUC is now used by a number of PSY researchers and is taught in one bachelor level and one master level course at IFI. Maude is also the main engine behind at least two well-established companies founded by previous students at the PSY group.

1.7 Open Science Policies

(A) Institutional Policies UiO has modern and clear policies for [open access](#) publication and [open research data management](#) (see Table 1 above). These guidelines and associated routines mandate that all members of staff must ensure that scientific articles deposited into the institutional repository can be made openly available as soon as possible. Conversely, research data must be made openly available, on equal terms, provided there are no legal, ethical or security reasons not to do so. An ongoing UiO-wide initiative works to update and strengthen data management practices in accordance with the FAIR principles (see also Section 2.2. (e) below). The University Library, through its Digital Scholarship Centre, jointly with the University IT Department provide guidance and courses about open access publishing, open research data access, and FAIR data management. These principles are well established among the staff at the department.

As a computer science department, the emergence of free and open software movement has had a particular impact on open science practices at IFI. The department, including in its current strategy, has long emphasized open standards and the use, promotion, and collaborative development of open software. Several of the research groups are centrally involved in open source community projects, providing software, data, and models; please see below for a few examples. Related to

these perspectives is the prominence of R&D at IFI predicated on involvement of citizen user groups and different kinds of stakeholders, in the Scandinavian participatory design tradition.

Also, regarding educational resources and on-line materials, IFI has traditionally taken a strong stand for open access. In part for these reasons, and contrasting with predominant use of a closed and monolithic learning management platform at UiO, the vast majority of courses at the department today base their on-line course environment on a combination of open and open source systems, e.g. publishing course materials through regular UiO web pages, submission of and feedback to large volumes of assignments through a locally developed open source platform, or student engagement and interaction through self-hosted Discourse and Mattermost instances.

(B) Import Contributions and Impact A few flagship examples of open source initiatives originating from IFI include:

- The DHIS2 health information management system (<https://dhis2.org/>), which is the software at the core of the global HISP collaboration (see Section 1.2 (a) *Structure* above), with a global developer community and installations in about 100 countries, primarily in the Global South.
- The Ultrasound Toolbox (<http://www.ustb.no>), a processing framework for ultrasound signals that facilitates the comparison of imaging techniques and the dissemination of research results. USTB has a growing user and developer community world, both in industry and academia.
- Collections of large language models (<http://norlm.nlpl.eu>) and training and evaluation data (<https://github.com/ltgoslo>) for Norwegian, including the top-performing Norwegian BERT (in 2023) and first open Norwegian GPT large language model, trained exclusively on public data.
- The high-performance VSEARCH tool for microbiome analysis, including chimera detection, clustering, dereplication, etc. (<https://github.com/torognes/vsearch>). Originally developed at IFI, VSEARCH has contributors and users from leading bioinformatics sites world-wide.
- The OTTR (<http://ottr.xyz/>) language and toolkit designed for representing and instantiating RDF graph and OWL ontology modelling patterns. With extensive functionality and documentation, OTTR has been successfully deployed in production in large corporate environments like DNV.
- IFI research groups regularly organize shared tasks (or “system bake-offs”), open and friendly method competitions with a common experimental protocol – for example standardized ML training and evaluation data – for comparability and replicability (e.g. <http://sdp.delph-in.net>).

(C) Data Ownership and Management, Confidentiality As a standard provision in their work contract with UiO, employees enter an agreement on the acquisition of rights to work results with a commercial potential, which in principle also applies to research data. This agreement entitles UiO to acquire all rights (right of ownership) to work results with commercial potential, and the employee has a right to remuneration from UiO. Open source licensing, however, is the predominant model and both embraced and encouraged at IFI. The UiO research data management policy provides guidelines on open-access, archiving, data publication, metadata, data management plans, and licenses. The university further provides a data storage guide that informs employees of where they can safely store different types of data. The university has also developed a service for sensitive data (dubbed TSD, which is now a national service infrastructure) where researchers can collect, store, and analyse sensitive research data in a secure environment.

1.8 SWOT Analysis for the Administrative Unit

Internal Strengths	The department is a “powerhouse” for informatics training and research in Northern Europe. With a staff of around 400 and some 2,500 students, it is the largest such unit in Norway and the one with the strongest international rankings. The department interprets and represents informatics in substantial breadth: from microelectronics, robotics and signal processing to digital entrepreneurship, information systems, and participatory design. There is strong in-house expertise in pretty much all core areas of informatics and a steady output of MSc and PhD graduates. A majority of the research groups at the department perform at a high international level and participate actively in competitive funding arenas. In particular, the department has seen good success in the current EU Framework Programme (if primarily as a partner in a large number of projects) and in ICT-related national programmes. In no small part owing to its broad and popular study offerings, the department has seen a substantial growth in the recent past. In parallel, a generation of “founding” staff have been replaced due to retirement. Combining these two developments, with a total of 28 new permanent faculty appointments only since January 2021, close to one third of permanent faculty, there is a large group of “fresh” staff in the process of integrating and establishing themselves. Since 2020, the department has strengthened its internal organization and management, with an increased focus on the division of roles and responsibilities and a growing collection of internal policies and “recipes”. Since 2021, the Deputy Head of Department has also been constituted as Head of Research. Overall, the department has excellent infrastructure and working conditions, including a culture of collegiate consensus, openness, and democratic values. Through past strategic prioritization, the department has been successful in building capacity in key evolving areas, e.g. information security, machine learning (including in application to computer vision, language technology, and robotics), informatics in distributed energy systems (“energy informatics”), digital health, and software engineering.
Internal Weaknesses	The department used to be organized with a flat internal structure, with about a dozen research groups that traditionally have served as the primary frame of reference for most staff. This structure has led to “silo” effects and limited interaction among research groups, particularly so in terms of joint R&D activities. Since 2020, the groups have been organized into larger thematic sections, and there is much ongoing work to strengthen cohesion within the sections and increase collaboration across individual groups. Some of the current research groups are comparatively small and highly specialized. They are, thus, vulnerable to unplanned or planned disruptions, e.g. longer leaves of absence or sabbaticals. This is

	particularly challenging in teaching and supervision, but can also affect mid- and longer-term research organization. In a few research groups, internal R&D collaboration also remains limited, further exacerbating such vulnerability. The department at large struggles to maintain a good balance between teaching and research activities. There is much external (and political) demand for training in informatics, both from other study programmes at the university and from outside, and much of the continuous growth in the evaluation period has been fuelled by increasing student numbers and a growing and increasingly diverse portfolio of study programmes, including life-long learning initiatives. Prioritization based on long-term strategic goals can be difficult in this landscape. Partly related to the above, there is a very uneven culture of participation in external funding programmes across research groups. Overall, the department has seen limited success in the most competitive arenas of excellence, and also in more impact-oriented “bread-and-butter” funding schemes, success rates have been variable. There is good representation in Pillar 2 of the HEU programme in recent years, though this is in no small part owed to a handful of active project managers. In terms of publication culture, we suspect some (regrettable) under-reporting in the national bibliometric statistics owing to weak internal routines (see Section 2 below. Compared to e.g. the informatics departments at NTNU or the Simula research laboratory, IFI has lower scientific production per scientific FTE in the evaluation period. At the same time, in terms of publications or author shares per FTE, the department has seen the most positive development between 2013 and 2021 among comparable units. This is an area for ongoing staff and culture development work. Doctoral training is an essential activity for the department, often in collaboration with external partners. Time to completion and average completion rates leave room for improvement. Both locally at UiO and nationally, the department seems less “visible” than should be expected given its size, breadth, and depth of activities.
External Opportunities	Societal interest in informatics at large and in several of the core areas of expertise at the department is high. Such heightened external attention and recognition of workforce demands is eminent in many government steering documents, like the current long-term plan for research and higher education, the 2023 “Perspective Report” on required competencies in Norway, the recent recommendation to launch a mega-programme for research in health technologies, and the creation of a new Ministry for Digitalization and Public Governance. In this climate, the department must represent informatics as a key discipline and seek to secure improved external conditions for foundational R&D. Trends like the “AI tsunami”, twin transition development, and increased focus on digital security will necessarily play to our strengths. The two largest sections at the department are Machine Learning and Digitalization. The latter of these represents interdisciplinary perspectives on informatics, in contact with users of information technology, organizations, industry,

	and society at large. Thus, the department is very well positioned to continue to contribute to digital and “green” transformation. In the larger Oslo area, the department enjoys the proximity and often close collaboration with larger and smaller players in the Norwegian (information) technology business. Through the UiO science and innovation park, incubator centre, and “start-up laboratory” next door and a central location and role in the emerging Oslo Science City initiative, the first innovation district in Norway, the department has excellent opportunities to further strengthen its innovation activities (where commercialization typically is facilitated through the joint technology transfer office of UiO and the Oslo University Hospital).
External Threats	External demand for increased training in informatics, in particular at the BSc level, as introductory contributions to other study programmes at UiO and through life-long learning options, presents the department with difficult choices and prioritizations. While heavily over-subscribed core courses speak to the importance of the discipline (and may over time help bring increased recognition), the department is pressed for capacity, not only in staff but also in more mundane matters like lecture halls, student laboratories, digital exam slots, and study administration. This development is overlayed with impact-oriented political expectations, geared towards shorter-term objectives, and highly thematic external funding. Taken together, these trends carry a stark risk of diluting strong traditions at IFI for long-term foundational research in informatics – which are the foundation for our international standing today. It can be challenging to balance teaching vs. research demands, on the one hand, as well as shorter-term “impact” vs. foundational “excellence” research, on the other hand. The department, however, must maintain and further strengthen its profile as a leading, research-intensive university department in informatics. Throughout the evaluation period, the Norwegian job market for specialists with informatics training has – by and large – been extraordinarily strong. This is of course both a blessing and a curse, leading to e.g. recruitment and retainment challenges starting as early as the MSc level. Hiring for doctoral, postdoctoral, and staff positions can be challenging in part owing to large salary differences between the private and the public sectors. This is exacerbated by the comparatively low “status” associated with science and higher education in Norway. Overall demographic trends in Norway and a negative development in student populations who specialize in the sciences in high school will limit recruitment options nationally. The department will want to further intensify international recruitment, but the current political landscape for student and staff mobility to Norway has proved increasingly challenging, with growing obstacles to recruitment from outside the EU and Western alliances.

2. Research Production, Quality, and Integrity

As a leading research-intensive informatics department, publication of R&D results in high-impact channels and international visibility in the form of citations are indicative of research culture and quality at IFI. The bibliometric analysis compiled by NIFU provides valuable insights in this regard. Its main data sources are the national CRISTin database of “valid” scientific publications, staff statistics from the Database for Higher Education (DBH), and citation data from the Web of Science (WoS).

CRISTin distinguishes two tiers of scientific quality, Level 1 and 2, but these are only indirectly taken into account in the NIFU analysis (where Level 2 publications give rise to higher author share weights). This two-tiered quality distinction is administered through discipline-specific national committees in the Norwegian Association of Higher Education Institutions (UHR), where Level 2 status is reserved for the (at most) 20% of publications that are judged to be of outstanding quality. Another distinction made in CRISTin but not exploited in the NIFU analysis is between different types of publications, where the following three categories are most relevant for IFI: (i) journal articles, (ii) parts of anthologies, and (iii) monographs.

In informatics, thoroughly peer-reviewed conference publications can be a vital and highly competitive channel for dissemination of R&D results, where top-tier conferences in sub-disciplines like machine learning often have acceptance rates as low as 20–25%. CRISTin allows registration of peer-reviewed conference publications in category (ii) – essentially as “book chapters” – provided they are associated with a registered publisher and have a valid ISBN (or, in rare cases, ISSN). These prerequisites are often not met, and common use patterns at IFI, at least, further lead to a comparatively low share of conference publications in CRISTin: For the period 2012–22, for example, a full 69% of all CRISTin items at IFI are journal articles (2540 of 3664). This distribution does not correspond to the totality of published results from IFI. For similar reasons, the WoS citation data cannot fully reflect the overall publication landscape in informatics. Nevertheless, it is reassuring to observe that the NIFU analysis attributes about 21% of the most cited papers (among those considered in the EVALMIT context, presumably) to IFI for the period 2019–21, combined with a mean normalized citation score well above the national average.

Publication counts per year are clearly affected by limitations imposed during the global pandemic, despite the suspected underrepresentation of conference publications in CRISTin, with a notable decline in 2020–22. However, when breaking down by different types of publications, it is reassuring to see that the total number of journal articles for the four-year period 2019–22 is 50% higher than for the earlier period 2012–15 (1078, compared to 718). For the same periods, the proportion of Level 2 articles has increased from 28% to 30% (202 of 718, and 323 of 1078, respectively). We interpret these more fine-grained views into the development at IFI throughout the evaluation period as positive indicators, even though it remains true that the stark growth in scientific staff since 2017 has yet to fully manifest itself through the CRISTin lens (See Section 1.1 *Strategy* above). Nevertheless, we observe that the department has had a positive development in terms of publications and in particular author shares per scientific staff year in the evaluation period.

2.1 Research Quality and Integrity

(A) Scientific Focus Areas The overall research strategy at IFI most recently centres around the thematic focus area *Green Informatics*, as introduced in Section 1.1 *Research Strategy*. The activities linked to this initiative capitalize on informatics as the central enabling discipline for sustainable and digital transformation (twin transitions). The department further strives to contribute to an increased understanding of our technological and societal responsibilities related to the climate and environmental crisis and pressing societal needs more broadly. In earlier strategy periods, since

around 2016, the department has prioritized the following subject areas, which all to at least some degree support green informatics: machine learning, information security, societal challenges related to energy and health, digitalization ecosystems and processes, and computing education. In addition, maintaining and further developing our strong traditions in core computer science, such as distributed systems, networks, programming technologies, and data and process modelling remains as important as ever. Here, the overarching intention is to maintain the scientific breadth and balance of core subjects.

Machine Learning Since 2020, the largest section at the department has clustered the research groups on *Digital Signal Processing and Image Analysis* (DSB), *Language Technologies* (LTG), *Robotics and Intelligent Systems* (ROBIN), *Scientific Computing, and Machine Learning* (SCML), and *Nanoelectronics* (NANO). These groups cover core areas of contemporary machine learning, in particular deep learning, and artificial intelligence – including computer vision, natural language processing, intelligent embedded and cyber-physical systems and general machine learning and scientific programming methods – and have all seen a very positive development in the evaluation period. Involvement in R&D excellence initiatives is strong among these groups, with e.g. DSB and LTG participating in a total of five SFIs, as well as in the newly launched SFF Integreat, on knowledge-based machine learning; ROBIN, already since 2017, is centrally involved in the SFF for Interdisciplinary Studies in Rhythm, Time, and Motion (RITMO). All groups in this section maintain a strong portfolio of national and international grants. Throughout most of the evaluation period, the department has offered aligned BSc and MSc study programmes in robotics and in language technologies. Starting from 2025, the language technology BSc will be broadened and relaunched as a new BSc study programme in artificial intelligence.

Information Security Strengthening the competence environments within information security is an articulated national priority, a perspective that affects a growing share of informatics sub-disciplines, and a prerequisite for sustainable digitalization. A great many students today want to specialize in information security, which also requires a strengthening of teaching and research capacity. Over the past few years, IFI has built up a dedicated research group for *Digital Security* (SEC) with currently four faculty (and further growth anticipated). The group enjoys excellent collaboration with the Norwegian Defence Research Establishment (FFI) and the Norwegian National Security Authority. Besides spearheading a popular new MSc study programme since 2020 and sustaining a decent portfolio of RCN-funded projects, the group has recently succeeded in joining several Horizon Europe consortia. Also other groups at IFI are increasingly engaged in security-related topics, for example the research groups for *Reliable Systems* (PSY), *Programming Technologies* (PT), and *Networks and Distributed Systems* (ND).

Societal Challenges: Energy and Health Method development and applications in medicine and health have long been central to a majority of research groups at IFI, with activity both towards analysis and modelling of biomedical systems, development of diagnostic methods and precision medicine, introduction of welfare technology and development, and studies of national and international health information systems. Health informatics therefore constitutes a central contribution at the department to the UN sustainability goals. During the evaluation period, the department has built up significant new activity within energy management through network architectures and protocols (a focal area dubbed “energy informatics”), with particular emphasis on distributed information and communication technology that supports smart energy grids and “prosumer” marketplaces – systems that enable private producers and consumers to trade directly among themselves – with strong emphasis on security and privacy. These activities are based in the ND research group, but also involve other groups and sections. IFI coordinates the UiO convergence environment on Privacy Preserving Transactive Energy Management (PriTem), involving no less than five UiO departments, the Norwegian Water Resources and Energy Directorate, and five commercial

partners. Several of the most highly cited researchers at IFI work in this area, which is also visible in the bibliometric analysis provided by NIFU.

Digitalization The second largest cluster of research groups at IFI is placed at the centre of profound organizational and societal changes. Our in-depth expertise in digitalization capitalizes on system aspects as well as user participation, knowledge-intensive work processes, and on ethics and societal aspects in digitalization processes. These perspectives require integration of knowledge from many of the research areas at the department, including programming technology, artificial intelligence, digital security, entrepreneurship, and platform ecosystems. In terms of new permanent staff and innovative interdisciplinary study programmes, the five research groups in the section for Digitalization have grown substantially in recent years. The research groups for *Digital Innovation* (DIN) and *Entrepreneurship* (ENT) participate in the interdisciplinary Centre for Innovation Policy for Industrial Transformation, Sustainability, and Digitalization (INTRANSIT), with RCN funding for the period 2019–26. This section also is home to the research group for *Information Systems* (IS), which today is the driving force behind the exceptional global success of the Health Information Systems Programme (HISP) and the associated centre at IFI. The research groups for *Design of Information Systems* (DESIGN) and *Regenerative Technologies* (RT), together with DIN and IS, have their foundations in the seminal work of Kristen Nygaard (see Section 1 above), whose participatory design perspective calls for involvement of groups of users as stakeholders in the full design process, from identifying problems to co-designing solutions. Together, these groups coordinate the second largest study programme at IFI, the joint BSc and MSc in *Informatics: Design, Use, and Interaction*.

Modelling, Software, Computing Education While not in itself a prioritized subject area in recent years, the section for Programming is a cornerstone of teaching and research at IFI. Within the section, a new research group on *Computing Education* (ITU) was formed in 2020 (which due to its small size in 2023 does not participate in EVALMIT). This group has as its focus the didactics of programming education, both at secondary and upper-secondary school and early university levels, a subject area that remains underdeveloped in Norway. The rationale for increased engagement in computing education at IFI was a recognition that “teaching the teachers” is a prerequisite to broadening basic digital competencies beyond specialist training in informatics, as well as to the continuous development of the educational agenda at and recruitment of students to IFI. Also in this section are the two research groups who were the driving forces behind the SFI for Scalable Data Access (SIRIUS), coordinated by IFI in the period 2015–23, viz. the groups for *Analytical Systems and Reasoning* (ASR) and *Reliable Systems* (PSY). Both groups maintain a very strong portfolio of national and international grants, including central involvement of ASR in the new SFF Integreat (see above). While all sections at the department contribute, the groups in the section for Programming take central roles in the largest study programme at IFI, the BSc and MSc in *Informatics: Programming and System and System Architecture*, with more than 250 BSc students starting in recent years.

	MSc	PhD
DIG	283	33
DIS	172	22
ML	200	45
PROG	176	24

As a coarse quantitative view on scientific contributions to the core subject areas at IFI, the table summarizes completed MSc and PhD degrees in the period 2018–22 for each of the four sections. The fairly recent reorganisation of IFI into four thematic research sections aims at strengthening and developing the above focus areas. Of the 26 new permanent faculty positions since 2017, the vast majority have been

defined and allocated according to these prioritizations (see Section 1.2 *Organisation*, Figure 2, for details). In total, these investments have helped extend and “modernize” the scientific profile of the department, even though it may take a few more years before this new and relatively “fresh” generation of faculty at IFI will have fully established themselves. In addition to these appointments, internally funded doctoral and postdoctoral fellowships are frequently used to stimulate activity within these areas, as well as to incentivize more research collaboration across groups and sections.

(B) Policy for Research Integrity The university has a well-developed multi-tier system for ensuring that research proceeds in compliance with the regulatory framework and general scientific and ethical norms. The individual researcher has an independent responsibility for ensuring that research is carried out in accordance with good research practices and recognized scientific and ethical principles. Researchers are obliged to familiarize themselves with and perform their research in accordance with the recognized research ethical standards applicable to the field. The University of Oslo has established a Standard for Research Integrity to clarify which sets of norms for research integrity hold for the university and its employees. Through IFI professor Jim Tørresen, the department participates in the National Committee for Research Ethics in Science and Technology, where Tørresen had an essential role in preparing the recent *Statement on Research Ethics in Artificial Intelligence* (2019). With involvement of IFI faculty, the university has recently implemented a course on research integrity open for all UiO academic staff, while doctoral fellows have mandatory courses on research integrity. At IFI, all staff and co-authors are expected to apply the Vancouver Conventions in determining co-authorship, and Vancouver compliance is part of the registration of publications to the national research index. The department keeps a particular focus on safeguarding of our doctoral candidates, for example through a low-threshold option to confidentially involve the Head of Doctoral Studies; the significance of this option is reflected by the number of doctoral candidates who make use of this opportunity every year. In addition, annual questionnaires allow the Head of Doctoral Studies and PhD administration at IFI to identify candidate problems and take suitable measures based on concerns.

2.2 Research infrastructures

(A) Participation in National Infrastructures The research conducted at IFI is diverse and, thus, depends on a variety of infrastructures. Core infrastructures used by many research groups are those that provide storage and computation services. Due to the varied requirements, there is no single infrastructure that fulfils every need.

Many IFI researchers use the **Sigma2 National Infrastructures**, see part (d) below. Of these, the Sigma2 Sensitive Data Service (**TSD**) solves storage and data analysis needs for sensitive research data that may include personal information and has seen the widest use among research groups. The Sigma2 National Infrastructure for Research Data (**NIRD**) provides vast data volumes for cooperative processing, with a direct connection to Sigma2 High Performance Computing (**HPC**); these services are popular primarily among researchers in machine learning. The most used national HPC systems are the Sigma2 supercluster **Saga** and the Sigma2 partition of the **LUMI** system, which is part of the EuroHPC ecosystem, see part (b) below. Additional needs for smaller-scale computation infrastructure are fulfilled by other national collaborations, including the Norwegian Research and Education Cloud (**NREC**) and the UiO platform Educloud Research; see part (d) below.

To address the specific technological and computational requirements of artificial intelligence R&D, the **NAIC National Infrastructure** (Norwegian Artificial Intelligence Cloud) has been launched recently, to develop an infrastructure for AI education, research, and innovation. It will comprise access to HPC resources and support to develop methods, models, and algorithms. The NAIC collaboration is supported by the department with staff resources and hosting of the NAIC team in the IFI building.

The exploration and advancement of high-performance computing itself rather than just using it, is the goal of the **eX3 National Infrastructure**, partnered by IFI. For example, eX3 has provided various configurations specifically for the SFI SIRIUS to explore specific technologies in heterogeneous compute clusters.

The **CLARINO National Infrastructure** (Common Language Resources and Technology Infrastructure Norway) is the Norwegian contribution to the European Strategy Forum on Research and Innovation (ESFRI) infrastructure **CLARIN**. IFI has been a project partner in the initial implementation of the national nodes, through the development of the CLARINO Language Analysis Portal. More recently, this line of development at IFI is complemented by the **Nordic Language Processing Laboratory** (NLPL), see part (d) below.

The **Elixir Norway National Infrastructure** is the Norwegian contribution to the ESFRI infrastructure Elixir. Through its participation in the Centre for Bioinformatics, which was supported by IFI with 2–3 FTEs in recent years including the centre manager, the department is a partner of the Elixir Norway project and host of the Oslo node of Elixir.

The **fourMS National Infrastructure** enables the study of human body movement and physiology in an immersive multimedia environment. IFI has been a fourMS partner for more than 15 years and has been instrumental in acquiring it through its participation in the SFF RITMO. IFI researchers are frequently using fourMS in RITMO-sponsored projects, as well as the RCN-funded projects EPEC and PIRC.

IFI researchers are frequent users of the distributed **NorFab National Infrastructure**, which provides micro- and nanotechnology fabrication and characterisation services for basic and applied research. IFI is a central contributor to NorFab, hosting three of its facilities. These are (i) an anechoic chamber, (ii) a Faraday cage, and (iii) an LPKF laser for microelectronics device manipulation. External users including the Norwegian Defence Research Establishment and several companies have already made use of these facilities. IFI is a user of other NorFab facilities, such as MiNaLab (at UiO) and micro-electromechanical system (MEMS) fabrication.

The **Peace Science Infrastructure** (PSI) is a recent *national infrastructure* for the development and provision of new automated tools for data collection from news and social media sources. PSI will establish an industry-standard infrastructure for the collection and management of event data. IFI is a member of the project for the development of PSI and supports through in-kind staff time and one doctoral fellowship.

UiO supports the **NorNet National Infrastructure** by hosting two measurements nodes. NorNet and its extension to a European measurement infrastructure, MONROE, have supported IFI research on both Internet and telecommunication infrastructure. Previously, similar research was supported by UiO hosting a pair of nodes supporting the discontinued global network experimentation platform PlanetLab.

Table 5: Participation in national infrastructure

Areas in roadmap	Name of research infrastructure	Period (from year to year)	Description	Link to website
Bioresources				
Biotechnology	ELIXIR Norway	2022-	ELIXIR3 – Strengthening the Norwegian Node of ELIXIR, ESFRI Landmark	https://elixir.no/
E-infrastructure	Sigma2	2006-	E-INFRA 2020 – A National e-infrastructure for Science	https://www.sigma2.no/
	NAIC	2022-	Norwegian Artificial Intelligence Cloud	
The humanities	CLARINO	2012–17 2020-	Common Language Resources Infrastructure Norway Upgrade	https://clarin.w.uib.no/
	fourMS	2009-	fourMs lab (Music, Mind, Motion, Machines), infrastructure for studies of human body movement and physiology in an immersive multimedia environment	https://www.uio.no/ritmo/english/research/labs/fourms/
ICT	eX3	2017-	Experimental Infrastructure for Exploration of Exascale Computing (Enables research on infrastructure for HPC)	
	NorNet	2011-	Norwegian Infrastructure for Network Experimentation	https://www.nntb.no/
Climate and the environment				
Environmentally friendly energy				
Maritime technology				
Medicine and health				
Nanotechnology and advanced materials	NORFAB	2022-	Norwegian Micro- and Nanofabrication Facility III B	https://www.norfab.no/
Petroleum Technology				
Social sciences and welfare	PSI	2022-	Peace Science Infrastructure	https://www.prio.org/projects/1998
Other infrastructure needs in the natural sciences and technology				

(B) Participation in international infrastructures The ongoing consolidation of the European research infrastructure has led to the establishment of ESFRI Landmarks and Thematic clusters, but various parts of the ecosystem that are foundational and not thematically specific exist as partners and enablers for ESFRI. Of these, **GÉANT**, se part (d), and **EuroHPC** are most important for IFI.

Norway is a member country of the EuroHPC Joint Undertaking since 2019 and represented in its board by the RCN. EuroHPC provides essential resources to conduct research on artificial intelligence and is used by several research groups of the institute. Among the entities that support our use of EuroHPC resources have been allocations through PRACE (Partnership for Advanced Computing in Europe). The EuroHPC supercomputer LUMI is also accessible to IFI through the partial Norwegian ownership managed by Sigma2, and the Head of Department represents Norway in the LUMI Scientific Advisory Board.

Another infrastructure with IFI involvement is **EBSI**, the European Blockchain Services Infrastructure, created on the initiative of the European Commission and the European Blockchain Partnership. The Blockchain Lab at IFI was selected to set up and host the Norwegian node as part of the European blockchain regulatory sandbox. IFI contributes staff time and receives funding from the Horizon Europe project EBSI-NE, which aims at fortifying the EBSI network by expanding it with 18 new nodes.

Table 6. Participation in international infrastructure

Project	Name	Period (Year - Year)	Description	Link to infrastructure
E-infrastructure				
EBSI	European Blockchain Services Infrastructure	2019-	Pan-European network of Blockchain nodes as a sandbox to create cross-border services for public administrations, businesses, citizens and their ecosystems to verify information and make services trustworthy	https://ec.europa.eu/digital-building-blocks/sites/display/EBSI
ICT				
EuroHPC-JU	EuroHPC Joint Undertaking	2021–2027	The leading European pool of supercomputers and a leading platform for artificial intelligence	https://eurohpc-ju.europa.eu/index_en
Other				
GÉANT	GÉANT	2000-	Pan-European network for scientific excellence, research, education and innovation	https://geant.org/
Europractice	EUROPRACTICE IC service	2012-	Pan-European chip infrastructure for design innovation for European academic and research institutions as well as European SMEs.	https://europractice-ic.com/

(C) Participation in European (ESFRI) infrastructures IFI contributes to ELIXIR, the distributed ESFRI Research Infrastructure for life science data, which is a pan-European infrastructure for biological information. It provides services and resources through national data infrastructures called ELIXIR Nodes. IFI is a major contributor to ELIXIR Norway, see part (a), through its hosting the UiO Centre for Bioinformatics (CBI), which coordinates the Oslo node of ELIXIR Norway. The node specializes in handling and processing of sensitive data. ELIXIR Norway is further supported by CBI participating in the European Open Science Cloud projects [EOSC-Nordic](#) (2019–2022), [EOSC4Cancer](#) (2022–2025), and the most recent initiative EOSC Entrust (from 2024).

IFI has contributed to CLARIN, the ESFRI Common Language Resources and Technology Infrastructure, a distributed digital infrastructure that provide access to language data and tools, please see part (a) above.

Table 7. Participation in infrastructures on the ESFRI Roadmap

Social sciences and the humanities				
Name	ESFRI-project	Summary of participation	Period	Link
CLARIN ERIC	Common Language Resources and Technology Infrastructure	Common Language Resources and Technology Infrastructure	2012–17	https://www.mn.uio.no/ifi/english/research/projects/clarino/
Biology and medicine (Life sciences)				
ELIXIR (EMBL)	European infrastructure for biological information, supporting life science research and its translation to medicine, agriculture, bioindustries and society	Hosting and managing the Oslo node of ELIXIR Norway, contributions through three EOSC projects.	2014–	https://elixir.no/
E-infrastructure				
PRACE	Partnership for Advanced Computing in Europe	Participation in a PRACE project gave access to compute resources including resources of EuroHPC.	2010–	https://prace-ri.eu/

(D) Access to research infrastructures Various storage and computation services are provided by the Norwegian Research and Education Cloud (**NREC**), a collaboration of UiO and UiB that exists since 2016. IFI hosts NREC personnel and IFI research groups are frequent NREC users. Prominent users are the SFIs SIRIUS and Media Futures, whose sharing infrastructure it hosts, and the SIRIUS-affiliated EU projects MELODIC and MORPHEMIC. The Educloud Research services at UiO are distinct from NREC, and especially its HPC system **Fox** is used by many research groups in teaching and research.

The Nordic Language Processing Laboratory (**NLPL**) enables large-scale NLP through a common stack in several Nordic HPC centres. NLPL is coordinated by IFI, and in collaboration with the IFI-hosted RCN-funded [SANT](#) project, IFI researchers have developed several top-performing large language models for Norwegian and made them available openly. NLPL has been supported by Sigma2, the

Nordic e-Infrastructure Collaboration (**NeIC**), [EOSC-Nordic](#), and most recently a HEU grant on web-scale NLP.

Internet access is, of course, essential for all research and operation, and UiO is connected to the Norwegian research network Uninett. Through its membership in the collaboration of European National Research and Education Networks (NRENs), **GÉANT**, it provides a distributed lab for research on networking itself, with the ND research group as the most active research user. GÉANT provides both monitoring services as well as quality guarantees for projects like the EU-funded Imagine-B5G.

Finally, to access design tools for integrated circuit design and multi-project wafers for prototype manufacturing, IFI makes use of **Europractice**. This service for researchers and SMEs was started by the European Commission and is a consortium of five European research organisations.

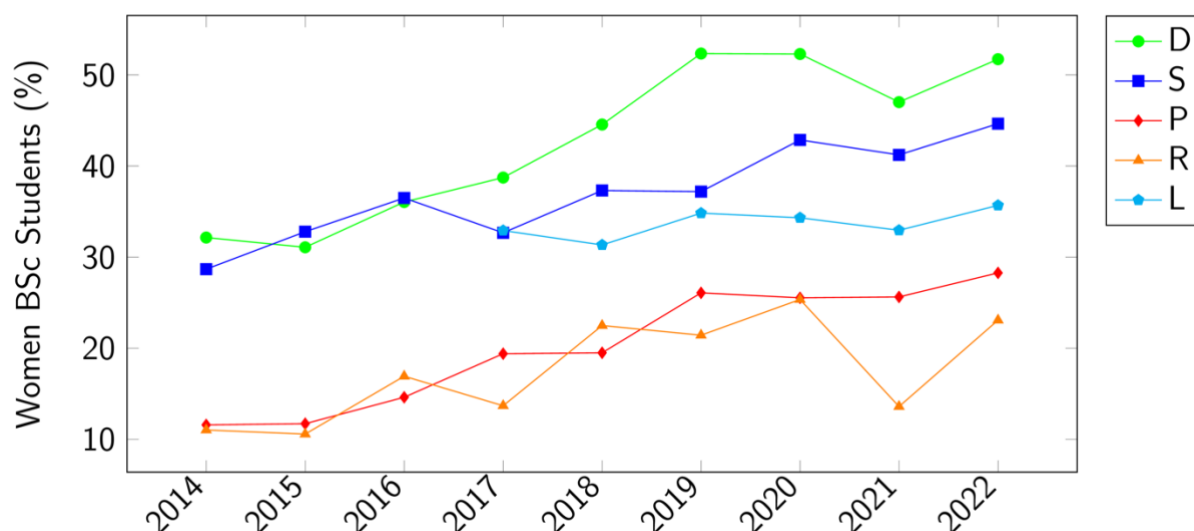
(E) FAIR Principles UiO has been an early adopter of the FAIR movement, with an internal project running since 2020 to increase awareness and understanding, as well as develop routines and integrated tool support – in storage and computing services at UiO – for FAIR data management. The university is committed to managing research data according to international standards, such as the FAIR and CARE principles, and thereby support the advancement of a global research community in which actionable research data is widely shared. The UiO IT Department and University Library both offer courses and support to researchers, based on a standard set of UiO-wide guidelines for research data management on the grounds of the FAIR principles. The IT support team at IFI provides local assistance and training to the scientific staff.

3. Diversity and Equality

Informatics has traditionally been a discipline characterized by low proportions of women students and staff. This is both a socio-economic and democratic problem. Even though we consider that the study and work environment at IFI overall is very good, it is revealed through surveys, anecdotal reports, and occasional incidents that gender and ethnic imbalance require constant attention to mitigate everyday challenges. Gender equality, for example, is harder to accomplish and maintain in an environment where women are starkly underrepresented. The department has worked systematically for the past two decades to counter-balance these effects, for example through active recruitment of diverse and visible role models and through measures reserved for underrepresented groups, e.g. recruitment, welcoming, and network events for women students. The overarching strategic goal here is that student and staff populations should reflect diversity in the Norwegian society at large, along relevant dimensions like gender, ethnicity, or social background. In line with recent research, we observe that the most effective measure for attracting and keeping underrepresented groups in informatics is to create an open environment with inclusive social arenas and an atmosphere of care and curiosity.

The staff overview in Table 2 above shows clearly that gender distribution at IFI today covaries with academic seniority: Close to 42% of doctoral fellows are women, which seems decent, but only 28% of postdoctoral fellows; one in three associate professors are women, but only 17% of full professors (the latter against a long-term strategic goal of at least 40% women professors). These effects are well known and can at best partially be explained by “effect lag”, i.e. delays in balancing measures propagating through career stages. The general philosophy at IFI has been to work “bottom-up”, e.g. address recruitment imbalances in its student and fellow populations, but also apply targeted measures when making faculty appointments. While the principle of premium scientific qualification has to be overarching here, IFI makes sure to (i) announce positions predominantly at the associate professor level, where a larger candidate pool is expected; (ii) appoint recruitment committees for each announcement, who specifically seek out and encourage potential women applicants; and (iii) instruct evaluation committees to adjust for “academic age” when comparing candidates, and to weigh gender imbalance in (rare) cases of equal qualification.

Figure 3: Women BSc students per year, *Design, Use, Interaction (D)*; *Language Technology (S)*; *Programming and System Architecture (P)*; *Robotics and Intelligent Systems (R)*; and *Digital Economics and Leadership (L)*.

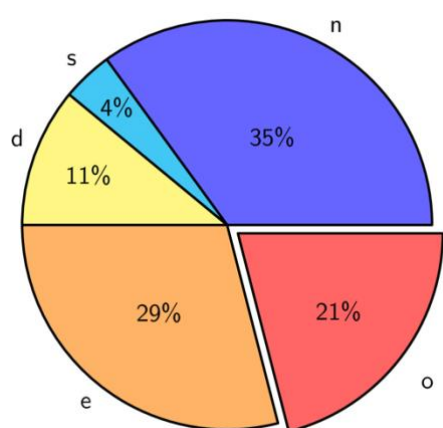


For the five aligned BSc and MSc study programmes at IFI, significant progress has been made over the years in recruiting higher proportions of incoming women students, as depicted in Figure 3. For

the three programmes with interdisciplinary elements – design and use, language processing, economy and strategy – proportions of new female BSc students in 2022 were 52%, 45%, and 36%, respectively (up from 32% and 29% in 2014, for design and language, respectively; 32% for economy in 2017, when the programme launched). For the largest study programme at the department – programming and system architecture – 29% new women BSc students in 2022 leaves room for further growth, but compared to 11% in 2014 this, too, is a very positive development. While retainment of students for MSc studies is a challenge in the current economic climate, there are no signs that gender imbalance increases already at these levels. Women shares among BSc graduates and new MSc students show a comparable development to the BSc statistics, if lagging with 5–10% lower proportions in 2022, which we attribute to delayed effects.

Doctoral training is a core part of R&D activities at IFI. Due to its structured nature, basic statistics of PhD degrees completed between 2018–22 can provide insights related to e.g. gender and culture equality. In this period, candidates on average used 5.0 years from start to disputation, with a median of 4.5 years. These statistics do not adjust for time spent on qualifying teaching duties, sick or maternal leaves, etc. In 2018, the average and median were 5.1 and 4.5, respectively, while in 2022 they were 4.6 and 4.1, respectively. The average time from start to disputation was 4.6 years for women and 5.1 years for men. Candidates with an MSc degree from outside Norway used 5.3 years, while candidates with a Norwegian MSc degree used 4.7.

Regarding staff recruitment, gender imbalance has received systematic attention throughout the evaluation period and some progress has been made. Between 2017 and 2022, 12 women associate professors have been appointed, of about 45 faculty appointments in total. Besides the measures sketched above, IFI routinely considers availability of strong women candidates when making allocation decisions for doctoral and postdoctoral fellowships. Through central participation in the RCN-funded *Female Researchers on Track* (FRONT) project, in the period 2015–22, all supervisors and managers have been trained to recognize and counteract bias and discrimination. Women staff has been offered networking arenas, specialized training, and support in career development. Concerning committees, other working groups at IFI, or visibility at department events, we strive for balance along gender, professional discipline, employee groups, student involvement, and age dimensions.



Besides gender, IFI also pays attention to diversity along other dimensions among students and staff. Plurality of backgrounds and perspectives is a core value. The department strives to embrace diversity and provide an inclusive study and work environment for all. (Post-)Doctoral fellows at IFI have long been a broad international community, but cultural and ethnic diversity is also increasing among permanent staff. As depicted in the pie chart, only half of the 28 faculty appointments made since 2021 came from Scandinavia: 35% Norwegian (labelled “n”), 4% Swedish (“s”), and 11% Danish (“d”). Other new permanent hires were comprised of 29% from Europe (“e”, (including Russia) and 21% from the Americas and Asia (“o”).

There is a broad and up-to-date body of applicable strategies and policies, both at the central UiO and MN Faculty levels, of which some are summarized in Table 8 below (others are only available In Norwegian). Since 2021, the Department Board has established a designated DEI council, with a mandate to (i) monitor diversity, equality, and inclusion at IFI, (ii) identify and address DEI-related challenges, (iii) propose and implement corrective measures, and (iv) liaison with DEI work at the MN Faculty and UiO at large.

This work is grounded in the UiO Strategy 2030, which mandates that both students and employees shall be included in a safe and positive study and work environment that brings out the best in everyone. This entails a pro-active approach to diversity, equality, and inclusion. UiO has a comprehensive system for reporting, investigating, and following up problematic or censurable behaviour, including (i) the on-line *Speak Up!* service, (ii) notification through line management, or (iii) options for anonymous reporting. Information about these services is part of common orientation and welcoming routines, where students and employees are encouraged to report any censurable condition or behaviour they experience or witness. Staff and managers who are involved in handling these reports benefit from skill development measures, e.g. training in difficult conversations and a network for case handlers. Overall, the *Speak Up!* system works with great professionalism, confidentiality, and integrity.

Table 8: Selection of policies and frameworks against discrimination applicable to the administrative unit.

No.	Title of document	Valid period	Link
1	University of Oslo: Policy for Diversity, Gender equality, and Inclusion	2021–2024	https://www.uio.no/english/about/strategy/gender-equality/index.html
2	University of Oslo: Action Plan for Diversity, Equality and Inclusion	2021–2024	https://www.uio.no/om/strategi/likestilling/titaksplaner/action-plan---lim-2021-2024_07.02.2023.pdf
3	University of Oslo: Ethical Guidelines	Adopted 2012	https://www.uio.no/english/about/regulations/ethical-guidelines/
4	University of Oslo: Guidelines against Harassment	Adopted 2019	https://www.uio.no/english/about/regulations/ethical-guidelines/harassment.html
5	University of Oslo: Procedure for Notification (Whistle Blowing)	Adopted 2018	https://www.uio.no/english/about/hse/speak-up/reporting/

4. Relevance to Sectorial Purposes

4.1 Sector-Specific Impact

As a “bread-and-butter” university department, our main sector-specific objectives are high-quality research, education, outreach, and innovation. Practically speaking all activity at IFI is directly aimed at these objectives. The university sector has a special responsibility for curiosity-driven foundational research, motivated by contributing to the knowledge base in general and building “knowledge reserves” for current and future societal challenges. This is an important aspect of our culture. A large part of R&D activities at IFI fall in this category. Indicators of R&D impact, in this sense, include (i) international recognition of our researchers and the department at large, (ii) quality of scientific publications and their reception (see Section 2 *Production* above), and (iii) success in competitive grant funding schemes (see Section 1.5 *Research Funding*).

That said, several of our research directions and activities also have direct societal impacts, for example through research and education for welfare, value creation, and innovation. The department offers specialized MSc programmes in, among others, *Digitalization in the Health Sector*, *Informatics: Digital Economy and Leadership*, and *Entrepreneurship and Innovation Management*, all grounded in current research at IFI, e.g. on health information systems and digital innovation and entrepreneurship (see also Section 5 *Societal Relevance*). Overall, R&D impact from IFI is of course also reflected in strong international rankings and a positive development on both the Shanghai and Times Higher Education discipline-specific rankings between 2018 and 2022, up from #63 to #38 (third in Europe) and from #201–250 to #126–150, respectively.

In addition, IFI produces a high number of BSc and MSc candidates each year, plus a comparatively large number of PhDs, see Section 4.3 below. Our approach to research-based teaching and R&D collaboration with past graduates implies that teaching and research activities are intertwined, i.e. cannot be viewed in isolation.

We believe that also the quality of training at IFI is of high international standing. The department has recently reviewed the 144 PhD theses that were evaluated at IFI in the period 2018–22. Each was assessed by an independent committee of experts, with at least two external experts. Of these, 68% were considered worthy of defence without changes, 24% were worthy of defence with only minor revisions, 6% were judged to have shortcomings that required major revisions and re-evaluation, and 2% were rejected. The portion of PhD theses considered worthy of defence without changes has increased from 58% in 2018 to 82% in 2022. After the PhD disputation, each assessment committee reports on the level of the degree compared to the general scientific level at the home institutions of the foreign opponents in the committee. Looking at the 81 theses evaluated at IFI in 2020–22, 1% was reported to be comparatively at a lower level, 68% were judged comparable to the reference level of the committee, and 31% were above that level.

4.2 Research Innovation and Commercialization

(A) Practices for Innovation and Commercialisation Contribution to innovation and commercialization is among the main pillars in the department strategy. Informatics is an applied science, and historically significant innovations have originated from IFI, like the first object-oriented programming language globally (SIMULA) and first internet provider in Norway (OsloNett). Later, technology pioneers like Elliptic Labs, Novelda, and Sonitor have been successfully spun out from IFI.

In line with strategic goals, innovation is considered a key target and researchers and students are encouraged to bring their R&D results into commercial deployment.

In 2021, the MN Faculty established an internal innovation unit, UiO Growth House, in collaboration with the Faculty of Medicine. UiO Growth House will facilitate a stronger innovation culture and will contribute to more knowledge from research being put to use. It helps researchers and students to mature early-stage ideas and provides tailored counselling, seed funding, meeting places, innovation mentor program, student internship and more. Later-stage innovation projects will be supported by the joint Technology Transfer Office (TTO) of UiO and the Oslo University Hospital – called Inven2 – for further commercialisation through license agreements and spin-out companies. This support includes patenting process and business development. Immediately adjacent to IFI is also the Oslo Science Park with its incubators for new startups: StartupLab for technology startups; Aleap for health startups; and Sharelab, a biotech lab incubator for academics, startups, and industry.

Background links to the relevant innovation ecosystem players are as follows:

Inven2 Technology Transfer Office https://www.inven2.com/?lang=en
Growth House https://www.uio.no/english/research/interfaculty-research-areas/life-science-growth-house/
Oslo Science Park, StartupLab https://startuplab.no/
Oslo Science Park, Aleap https://www.aleap.no/
Oslo Science Park, ShareLab https://sharelab.no/

In the evaluation period, several companies have been founded by department employees or students. Examples of companies are [DoMore Diagnostics](#), [Equanostic](#), [Kindly AI](#), [No Isolation](#), [Oda](#), [Onio](#), [Prosa Security](#). These again have already led to indirect spin-offs which should also be mentioned in this context, as they illustrate the impact of research driven innovation, where fundamental technology innovation trigger value-creation higher in the value chain.

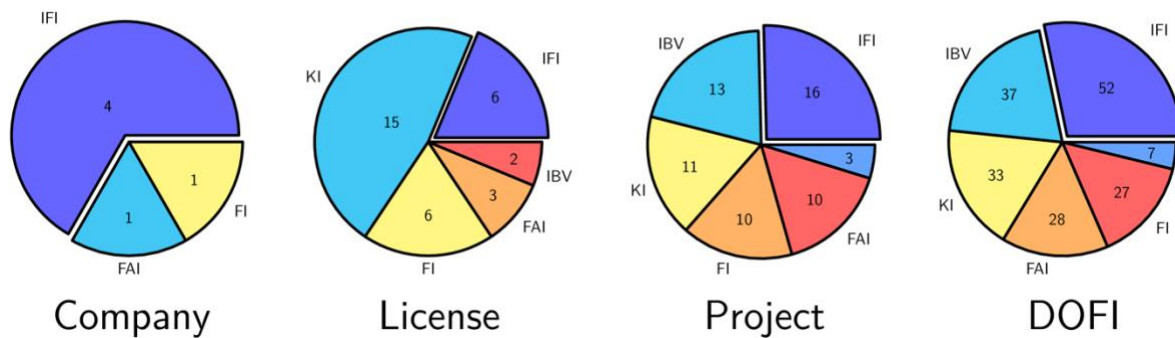
The department also has a strong collaboration with industry documented through industrial PhDs and participation in RCN Innovation projects (IPN) coordinated by industry. In the period 2018–22 the department hosted ten industrial PhDs and participated in eight RCN Innovation projects. Besides providing research results, these projects may also lead to new product- or process innovations within the collaborating companies.

Seven patents have also been reported by researchers in the period. Examples of such innovation are listed in Table 10 below.

(B) Motivation among Research Staff Innovation within academia is normally driven by motivation for value creation combined with substantial research leading to innovation height and differentiation. Thus, like research, innovation cannot be forced but must be facilitated and nurtured. IFI strives to provide a creative and inspiring environment for researchers to catalyse ideas and research into tangible innovations and commercialisations. It should be recognized that department activities span a wide range of R&D from microelectronics to user interaction, where some fields by nature are closer to commercial deployment.

It is hard to quantify motivation for innovation, but suitable indicators are (i) Disclosures of Innovations (DOFI) filed, (ii) TTO projects approved, (iii) license agreements, and of course (iv) company registrations. Statistics from Inven2 and [Menon Economics](#) (2017–21, see below) show that 52 DOFIs were submitted from the department (representing 30% of MN Faculty volume), of which 16 ended up in commercialization projects, again resulting in six license agreement and four registered companies (67% of MN Faculty volume). These figures indicate good motivation among research staff in doing innovation and commercialization. In particular, the very high share of companies established tells that ideas from the department are substantial. Figure 4 below ([Menon Economics](#); UiO University Board meeting of June 23, 2023) illustrates a comparison against other departments at the MN Faculty, Biosciences (IBV), Chemistry (KI), Pharmacy (FAI), and Physics (FI).

Figure 4: Statistics over innovation and commercialization activities at various MN departments.



Since 2011, the University of Oslo has granted the UiO Innovation Award to researchers with significant contribution to research driven innovation. In the evaluation period, two awards winners are department researchers (2013 and 2022).

(C) Support Innovation and Commercialization The department supports innovation and commercialization for both students and researchers. For students, Ifi has established "Sonen", the department's makerspace. Sonen is a freely open creative playroom and meeting place for all engaged and curious students, and it serves as a laboratory for experimental informatics.

Back in 1999, the department established "Gründerskolen," an intensive summer program in entrepreneurship and business development that combines theory and practice in some of the world's best innovation environments. The program was expanded as a national offering after a few years and is now available to students at a total of eight Norwegian educational institutions. The program includes 10 weeks of practical experience in a startup abroad. Over the years, the program has sent students to places as Boston, San Francisco, Toronto, Singapore, Houston, London, and Shanghai. The program is administered by the research group for Entrepreneurship (ENT), which is part of the section for Digitalization. The group provides education, research, and promotes research-based innovation and entrepreneurship. It is a strategic tool for UiO at large for teaching and showcasing entrepreneurial activities, including dissemination and commercialization of research results.

For support to researchers, the department has its own research administration, in addition to the ones at the Faculty and central level. In 2022, the MN Faculty took part in the establishment of UiO Growth House. Their goal is to help students and researchers further develop early-stage ideas. In addition, UiO has a technology transfer office (Invent2) that develops and manages ideas and progresses with ideas that can be turned into socially useful products and services.

To support good ideas, UiO Growth House has funds that can be awarded to researchers and students. Invent2 has idea prizes where good ideas can win up to 250 kNOK. In addition, students can apply for STUD-ENT funding for good ideas from the Research Council for up to one million NOK.

Table 9: Policies for innovation including IP policies, new patents, licenses, start-up/spin-off guidelines.

No.	Title	Valid period	Link
1	Policy for intellectual property rights at the University of Oslo	2005-	https://www.uio.no/english/about/regulations/research/intellectual-property/
2	Regulations for sideline jobs and owner interests at the University of Oslo	2006-	https://www.uio.no/english/about/regulations/personnel/common/external-work-rules.html
3	Rights retention policy at the University of Oslo	2023-	https://www.ub.uio.no/english/writing-publishing/open-access/documents/rights-retention-policy.html

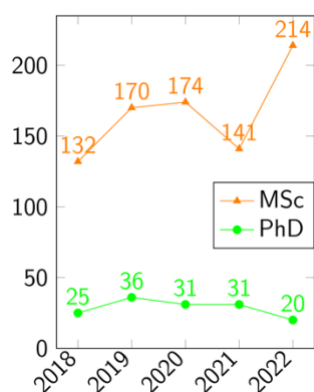
Table 10: Administrative description of successful innovation and commercialisation results.

No.	Name of innovation and commercial results	Description of innovation and commercial result	Link
1	Greps: Science-Based Testing Platform for Software Developers	Continuous development of a product for measuring coding skill. Spin-off company established.	https://www.greps.com/
2	DoMore Diagnostics	DoMore Diagnostics uses artificial intelligence to make personalized treatment decisions simple and accessible for all cancer patients. Its unique digital biomarkers predict patient outcomes from routine tumor tissue slides and can be seamlessly integrated into pathologists' existing workflow. The company was established based on research performed in the DoMore project where IFI was a main research partner.	https://www.domorediagnostics.com/
3	<i>The DHIS2 software</i> , with related resources such as impact stories:	Newest version (40) was released 14/09/2023	http://dhis2.org https://www.mn.uio.no/hisp/english/ https://dhis2.org/category/impact-stories/
4	Method of computing balanced routing paths in fat-trees	2019/Patent	US10425324B2 https://patents.google.com/patent/US10425324B2/en?q=US10425324B2

5	System and method of computing Ethernet routing paths	2018/Patent	US20190149461A1 https://patents.google.com/patent/US20190149461A1
6	Eidel Patent Solsensor	Product development ongoing, licence agreement between UiO and Eidel in June 2018. Patent application in March 2018.	https://eidel.no/en/product/miniaturized-sun-sensor/ UK patent application 'light source position sensor', GB1803670.7, https://www.ipo.gov.uk/pro-types/pro-patent/pro-p-os/pro-p-journal/p-pi?startYear=2018&startMonth=April&startDay=25th+-+6727&endYear=2018&endMonth=April&endDay=25th+-+6727&filter=GB1803670.7&perPage=10&sort=Date+Lodged
7	Antenna deployed in Lenovo Laptop HPD modules	Antennas developed during RCN WellSafe project enabled world's smallest UWB module	https://medium.com/novelda-news/two-new-lenovo-laptops-with-the-novelda-hpd-sensor-launched-at-ces-2021-c82fc67f3ee7
8	Secure data processing	European patent EP2827276 granted 2019-07-03 • Published 2019-07-03	https://patentimages.storage.googleapis.com/4f/41/c8/71a1ca966ac855/EP2827276B1.pdf
9	Load-balancing and scaling of cloud resources by migrating a data session	European patent EP3046028 granted 2020-02-19 • Published 2020-02-19	https://patentimages.storage.googleapis.com/50/9c/70/ede0ce4d8676f5/EP3046028B1.pdf
10	A predictor for breast cancer patients of response to neoadjuvant treatment with a VEGF inhibitor (ViRP)	PCT patent application WO2021156137, filed 2021	Paper: https://ascopubs.org/doi/full/10.1200/PO.20.00086 Patent filing: https://worldwide.espacenet.com/publicationDetails/biblio?CC=WO&NR=2021156137A1&KC=A1&FT=D#

4.3 Higher Education Institutions

(A) Research Contribution to MSc and PhD Education All PhD theses obviously are the result of research, which is carried out in the context of a research project involving a community of researchers, within a research group, across research groups, and often in collaboration with external partners from other universities, institutes, industry, or the public sector. Conversely, IFI faculty frequently contributes to the supervision of doctoral candidates at other institutions, although there is no quantitative data on the volume of such “academic communityhood”. Also, the vast majority of MSc theses supervised at IFI contain clear elements of research and are, likewise, typically carried out in a community of researchers, centered around the main supervisor and their research group. PhD students are required to have a team of at least two supervisors, and MSc also frequently have more than one supervisor.



With IFI accounting for about one fifth of all staff at the MN Faculty, our share of total teaching activity at the Faculty – in terms of credit points and degrees – is approaching 45% in recent years (and around 20–25% of all doctoral degrees). The figure visualizes MSc and PhD degrees over the past five years, with a substantial growth at the MSc level, despite a stark short-term effect of the global pandemic. For PhD degrees, post-pandemic recovery appears to take longer, but with 29 completed degrees in 2023, IFI today appears headed for comparable levels as before the pandemic. A substantial number of non-informatics students – from other study programmes at the MN Faculty or other parts of UiO, as well as participants in life-long learning programmes – also take

introductory courses at IFI. The department puts an emphasis on reflecting research through our courses and on continually updating courses and the course portfolio with recent advances at all levels. Thus, research is disseminated also to a large extent through the course portfolio and contents, providing an impact on a large and diverse community.

(B) Opportunities for MSc Students to Involve in Research In addition to the general research-driven approach to master and PhD supervision and thesis work described above, IFI has in the period 2018–22 piloted a research programme for BSc and MSc students, with the aim to promote and increase student interest in pursuing a PhD degree. BSc students at the verge of completing their second year were selected based on their grade average as well as a statement of interest and interviews. The research programme consisted of 30 ECTS specialized courses during the third year of the BSc degree and another 30 ECTS during the Msc degree. Each student was assigned to a research group and allocated a mentor. Students from two of the aligned BSc and MSc study programmes were selected for participation in the pilot. Even though the pilot did not reach full capacity, its outcome was positive in terms of new PhD candidates recruited among IFI students, and in particular in the number of women candidates. The administrative cost of the pilot was high, however. Following up from an evaluation of the research programme, the department is now redesigning this programme, in order to be able to offer early R&D immersion to more BSc and MSc students, but with reduced administrative overhead.

IFI is also working to increase the number of project summer internships. Summer internships have been used to a very limited extent so far, partly because a large number of IFI students (more than 200 students a year) already have part-time jobs at the department during the spring and autumn semesters, for e.g. laboratory and grading assistance, such that a substantial budget is already targeted to student jobs at the department.

4.4 Research Institutes

NA

5. Relevance to Society

Informatics is a key discipline in two ongoing fundamental transformations of society, the digital and the green transitions. It is hard to obtain reliable estimates, but the carbon footprint and water consumption associated with information and communication technologies – e.g. data centers, communication infrastructure, cloud services, and consumer devices – today is often compared to the aviation industry. Informatics must not become a part of the problem but rather serve as the key to innovative solutions. IFI develops and offers knowledge, methods and technologies that profoundly contribute to digital and sustainable societal change. In recognition of this, sustainability is keyed as one of our four core values, highlighted in the most recent strategic plan for the period 2022–2026 (see Section 1). Through the department-wide thematic initiative Green Informatics, IFI strives to emphasise and promote activities that support the UN Sustainable Development Goals, notably those addressing environmental sustainability, energy, and health. All our research groups have substantial activity within the framework of Green Informatics.

Pertaining to the Norwegian government white paper *Long-Term Plan for Research and Education*, our activities contribute to the overall goal of increased competitiveness and innovation in a multitude of ways: Through educating highly qualified candidates on all levels (BSc, MSc, and PhD), by research within a large number of areas that relate to the green and digital transition, by improving industry and public-sector participation and investment in research and development through collaboration projects, as well as by supervising of industrial and public-sector doctoral candidates, by advancing EU knowledge investments for the green and digital transition through leadership or participation in EU projects, and more. Our selection of five impact cases from R&D at IFI – see below – serve as an illustration of our direct contribution to the thematic areas in the white paper, which are (i) Ocean and Coast; (ii) Health; (iii) Climate, Environment, and Energy; and (iv) Enabling Technologies. Impact cases #1 – *eHealth Infrastructures* – and #3 – *Machine Learning for Improved Cardiac Ultrasound* – relate to health as well as enabling technologies. Impact case #2 – *Knowledge-Driven Transformation of Engineering and Operations in Capital-Intensive Energy Facilities* – relates mainly to ocean and coast, and to enabling technologies. Finally, impact cases #4 – *Low-Cost Miniaturized UWB Antenna* – and #5 – *TAPS Transport services* – relate mainly to enabling technologies, though #4 also constitutes a contribution towards climate, environment and energy.