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DEGREE: Philosophiae Doctor

FACULTY: The Faculty of Mathematics and Natural Sciences

DEPARTMENT: Department of Informatics

AREA OF EXPERTISE: Semantic Interoperability

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DISSERTATION TITLE: *Enabling Semantic Interoperability for State-owned Real Property Data*

Real property, also known as real estate, realty or immovable property, is one of the most important assets for the global economy. Real property is a central element in the building and construction industry, which has been witnessing a digitalization process in the recent years. Digital Twins, Internet of Things and Sensor Technology, Artificial Intelligence and Machine Learning, Smart Buildings and Smart Cities, are examples of data-driven domains that potentially have a transformative impact in the building and construction industry. For such transformative impact to happen, availability and quality of well-integrated real property data are of paramount importance.

Real property data integration is a challenging task due to the complexity and heterogeneity of real property data. Data is distributed across several domain-specific systems and comes with different quality. Examples of well-known sources for real property data include cadastral systems, real property management systems, and real property transaction systems. Real property contextual data, such as weather, natural hazards, transport, rules and regulations, and sensor data, is also essential for the decision-making process in the building and construction industry.

This main contribution of this thesis is advancing the knowledge in the area of real property data integration. In particular, the thesis demonstrates the use of semantic technologies for integration of real property data in delivering novel services for reporting of state-owned real properties in Norway, and assessing the risk and vulnerability of real properties. The work covers the design and realization of a real property ontology based on case studies, publication of real property data as linked data, and application scenarios of the integrated real property data. Furthermore, it analyses the challenges in integrating real property data based on case studies and provides a rule-based semantically enhanced method to improve data quality both in the source systems and within the integrated data. It also surveys and analyses existing real property ontologies and conceptual models.

Ling Shi has worked for the past 10 years as an integration architect in the ICT department at Statsbygg (Norway). She holds a M.Sc. degree in Computer Science from University of Oslo (Norway) and an M.Phil. degree in System Dynamics from University of Bergen (Norway).