# Semantic Web for Streamlining Building Design and Permitting Processes Poster abstract

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### Abstract

This study aims to comprehensively examine the building permit process. Through a short literature analysis, it is identified that existing research often overlooks the holistic investigation of information flow between stakeholders and systems, hindering the development of digital or automated solutions.

To address existing gaps, the study proposes integrating ontologies and Semantic Web technologies to streamline code compliance auditing processes and enhance interoperability. The study also evaluates the impact of digital building permits on the adoption of digitalization practices in the construction industry.

### Keywords
Digital building permit, BIM, semantic web, data interoperability, ontologies, review

## 1. Introduction

The process of obtaining a building permit is often complicated and time-consuming, which can delay construction projects [1]. The building design and permitting process involves many steps, stakeholders, interdisciplinary aspects, and labor-intensive processes, making it inefficient and challenging. Current isolated digitalization initiatives have failed to adequately address these issues.

This study aims to examine the building permit process holistically using ontologies and semantic web technologies. The main objective is to understand how a digital building permit can encourage the construction industry to adopt digitalization practices. The Estonian Building Registry (EBR), developed to streamline the building permit process, is a pilot case in this research. The study will analyze the workflows of EBR and explore how ontologies and semantic web technologies can help overcome the challenges of the building permit process [2].

## 2. Short Literature Review

Digital building permitting has seen significant improvements with compliance-checking technologies and digitization of regulatory frameworks. However, automating code compliance checking through BIM remains a major challenge due to complex rule interpretation, BIM models, and standardizing information requirements [1]. Previous research on the issue has been isolated and has often overlooked the holistic investigation of information flow between stakeholders and systems [3]. Even though various approaches have been developed to automate sub-steps, there is lack of integration between them [4]. To streamline the process, it is important to integrate the building permit review workflow with building data and automated

code compliance checking [5]. However, the lack of fundamental research and detailed investigation of each sub-process within the permit process is hindering the development of digital or automated solutions [1]. Further research is needed to address data and interoperability issues. Thus, EUnet4DBP was established, consisting of researchers, public bodies, the private sector, and many other stakeholders who are working together to develop a solution for the building permit process that can be scaled internationally [4].

The interoperability approach in the construction industry relies on the IFC format, but it has its complications [3]. To address the industry's data heterogeneity problem and streamline the manual code compliance-auditing process, ontology standardization is crucial. An ontology-based building permit review (OntoBPR) concept has been proposed, supported by Semantic Web technologies and domain-specific ontologies. It includes regulatory and administrative rule-checking and Ontology for Building Permit Authorities (OBPA) [5] is one such example. The technical benefits of using ontologies include modularity and flexibility. The use of the Semantic Web can enable the processing of data in a distributed manner, thereby promoting objectivity, transparency, and robust decision-making in building permit review processes [5].

## 3. Research Program and Pilot Description

This research is part of a Ph.D. program. The focus of the study is to examine building permitting processes in a holistic manner, utilizing ontologies and semantic web technologies.

The research will first conduct a systemic literature review to identify existing workflows and technologies proposed by researchers in the field. It will also identify the current challenges and inefficiencies in the building permit process, and how researchers have proposed addressing these challenges through digitalization initiatives. Furthermore, the review will highlight the limitations of existing approaches and identify research gaps.

Following the literature review, the research will explore the feasibility and potential benefits of implementing a digital building permit. The study will use the EBR as a test case and assess how it can encourage the construction industry to embrace digitalization practices.

## 4. Conclusion

This research proposes a comprehensive approach to digital building permit processes, using the Estonian Building Registry as an example. It proposes integrating ontologies and Semantic Web technologies to improve clarity in the building permit process.

The study will evaluate the impact of a digital building permit on the construction industry, with the aim of encouraging the adoption of digitalization practices. Overall, this research aims to contribute to the ongoing evolution of building permitting processes by offering insights and proposing tangible solutions.

## References

[1] T. Bloch and J. Fauth, 'The unbalanced research on digitalization and automation of the building permitting process', *Adv. Eng. Inform.*, vol. 58, p. 102188, Oct. 2023, doi: 10.1016/j.aei.2023.102188.

[2]     Ministry of Economic Affairs & Communications, 'BIM-based Building Permit Process'. [Online]. Available: https://eehitus.ee/timeline-post/bim-based-building-permit-process/

[3]     F. Noardo, T. Wu, K. Arroyo Ohori, T. Krijnen, and J. Stoter, 'IFC models for semi-automating common planning checks for building permits', *Autom. Constr.*, vol. 134, p. 104097, Feb. 2022, doi: 10.1016/j.autcon.2021.104097.

[4]     F. Noardo *et al.*, 'Unveiling the actual progress of Digital Building Permit: Getting awareness through a critical state of the art review', *Build. Environ.*, vol. 213, p. 108854, Apr. 2022, doi: 10.1016/j.buildenv.2022.108854.

[5]     S. Zentgraf *et al.*, 'OntoBPR: Ontology-based workflow and concept for building permit reviews', Jul. 2023.