Resource use efficiency of timber

A feasibility research
Acknowledgments

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Abstract

As the world’s population and welfare are on the rise, the pressure on natural resources such as timber is increasing rapidly. Therefore, it is becoming ever more important that the consumption of these materials becomes more efficient by enhancing the recycling- and reuse economy. This research scopes down to one product in particular: timber. This research is aimed at 1) identifying technical options that can be used to improve timber use efficiency in the construction industry, and 2) exploring the factors that determine the feasibility of implementing these technical options. Industrial ecology literature is used to identify, five options and their technical potential to reduce the amount of timber waste: prefabrication, Industrial Flexible Demountable (IFD) construction, timber skeleton construction, glued timber construction and selective removal of timber for reuse and recycling. Additionally, governance literature is examined to understand the social dimension of implementation. To be able to obtain insight on the feasibility of implementing these options in the construction sector, interviews are conducted with public actors, private actors and the scientific community. Representatives from licensing authorities, commissioning authorities, designers, contractors, branch organizations and knowledge brokers were included. The results generated by these interviews indicate that the progress towards implementing technical options to improve timber use efficiency is slow. The factors that influence the feasibility of implementation process relate to actor characteristics, institutional context within which the construction industry functions, and the policy content that regulates this industry. As for the actor-based features, results indicate that the feasibility of creating a coalition between the above mentioned actor groups is compromised due to competing interests and priorities between them. With regard to institutional features, project-based cooperation and changing constellations of actors result in a lack of knowledge institutionalization and shared responsibility, which limit the opportunities for improving timber use efficiency. The influence of the policy content on timber use efficiency is weak; licensing authorities devote little attention to timber use efficiency. The main focus appears to be on regulating energy consumption during the use phase of buildings. This research provides the reader with an in-depth understanding of how these factors influence the implementation of options that improve timber use efficiency.

Keywords: Construction, efficiency, innovation, institutions, timber use, policy content
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Literature


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List of interviews:


Architect (2012). Interview conducted by Marc Leijtens, Amsterdam, January 21, 2012


Branch organization representative (2011). Interview conducted by Marc Leijtens, Almere, December 9, 2011

Branch organization representative (2012). Interview conducted by Marc Leijtens, Bussum January 18, 2012

Branch organization representative (2012). Interviewed by Marc Leijtens, Zaltbommel, January 24, 2012

Branch organization representative (2012). Interview conducted by Marc Leijtens, Uithoorn, January 26, 2012

Commissioning authority representative (2012). Interview conducted by Marc Leijtens, Amsterdam, December 19, 2012

Commissioning authority representative (2012). Interview conducted by Marc Leijtens, Amsterdam, December 29, 2011

Commissioning authority representative (2012). Interview conducted by Marc Leijtens, Amsterdam, January 11, 2012

Contractor (2012). Interview conducted by Marc Leijtens, Vroomshoop, January 16, 2012

Contractor (2012). Interview conducted by Marc Leijtens, Uithoorn, January 26, 2012

Licensing authority representative (2012). Interview conducted by Marc Leijtens, Utrecht December 15, 2011

Licensing authority representative (2012). Interview conducted by Marc Leijtens, Zoetermeer, January 10, 2012

Licensing authority representative (2012). Interview conducted by Marc Leijtens, Amersfoort, January 13, 2012

Licensing authority representative (2012). Interview conducted by Marc Leijtens, January 17, 2012

Researcher (2012). Interview conducted by Marc Leijtens, Utrecht, January 4, 2012

Researcher (2012). Interview conducted by Marc Leijtens, Wageningen, January 11, 2012