End-to-end requirements management for multiprojects in the construction industry

The research described in this PhD thesis focuses on the phenomenon that formalized requirements management, as many studies have shown, has yet to find its way into the construction industry, even though it is effectively used in other fields e.g. software development and the aerospace and defense industries. The research gives at the same time managers of construction projects a tool with which to manage their requirements end-to-end. In order to investigate how construction companies handle requirements, a case project – a Danish construction syndicate producing sandwich elements made from High Performance Concrete and insulation materials – is used. By means of action research and interviews of case project staff it has become evident that many elements of formalized requirements management are missing in the case project. To fill those gaps and be able to manage requirements end-to-end a requirements structure is developed and tested as a starting point. This requirements structure is able to handle the encountered standard and non-standard situations such as product development and technology development in parallel with executing a construction project. At the same time the requirements structure is aimed at covering the entire life cycle of a building by considering future events.

However, the developed requirements structure is not enough for managing requirements. Therefore an intensive literature study on requirements management in general and in particular requirements management in construction is performed. The results of this literature study show that very little has been written about applying requirements management to the field of construction even though some authors have proposed to do so. This is a first indication that the entire field of construction lacks research with regards to requirements management. As the literature study gives little new information, a series of interviews are initiated with experts from industry and universities. Those interviews reveal major shortcomings in the way requirements are handled in Danish construction companies today. In order to give managers of construction projects a useful and guiding tool for formally managing requirements that is rooted in practice, the “Conceptual requirements management framework”, is created. The framework builds upon the gathered empirical data, obtained by action research, interviews, and available literature and is therefore inductive in nature. The “Conceptual requirements management framework” is tested and validated by applying it to a building project and using additional methods of validation e.g. traces, extreme-condition tests, and face-validity.

The development and application of the requirements structure and the Conceptual requirements management framework mean that, for the first time structured requirements management and elements of systems engineering have been used in the construction industry. It is expected that this approach counters some of the major challenges that are present in the industry by contributing to rework being avoided, shortened lead-times, less spending of resources, better quality, and a higher degree of satisfaction of stakeholders. The results of the conducted research show that formal requirements management can successfully be applied to the construction industry that was examined. At the same time it is necessary to open doors to further research:

• The “Conceptual requirements management framework” has to be applied to additional building projects in order to gather more data for the improvement of the framework
• This research does not cover the long term effect of introducing requirements management to the construction industry and its customers. An investigation would be beneficial for the industry and academia

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