Integrating Lean Design and Lean Construction: Processes and methods

Inspired by the industrial manufacturing debate of the late 1980's and the early 1990s, lean construction emerged from attempts of transferring and applying a Japanese (lean) production philosophy to the construction industry. Application of the lean philosophy - which prescribes the enhancement of value and elimination of waste as perceived by the end customer - has diffused slower and more uneven into construction compared to manufacturing, where it became a leading production and management trend of the late 1990s and the first half of the 2000s. However, lean construction has become a well-established theme on the construction agenda in some countries (e.g., in Denmark and the UK). Hitherto, lean construction has, in debate and practice, primarily focussed on production aspects. Gradually, however, design issues have started to receive more attention and lean application to construction design is commonly referred to as lean design. Another important theme of recent years' debate on developing the construction industry and its project delivery practices is integration of project processes which has often been identified as a key issue regarding construction performance improvement. Issues of integration of construction design and production activities from a lean perspective are beginning to be addressed by the construction industry but have not yet been thoroughly and systematically investigated. Motivated by this situation, this thesis aims to address the following two research questions:

Research question 1: Is the lean philosophy appropriate as a means for pursuing integration of construction design and production processes?

Research question 2: Which processes and/or methods and/or issues are crucial or critical for integrating construction design and production from a perspective of the lean philosophy?

A review of literature on the lean philosophy and its application to manufacturing industries and construction reveals that the lean philosophy is highly interpretive and that there is no shared definition or understanding of what is meant by 'lean', 'lean production', 'lean construction', etc. Regarding the first question, it is concluded that as a mean for pursuing design/construction process integration the lean philosophy can be appropriate, though not on its own, and provided that the notion of 'end customer' is (re)defined to represent a wider range of construction stakeholders including wider society. The second research question is explored through previous research and the findings from three ethnographic case studies from Denmark and USA. On this basis, it is concluded that processes/methods crucial or critical for pursuing design/construction integration from the perspective of the lean philosophy are:

- Value identification, specification and communication;
- Establishing an appropriate project delivery framework;
- Project organisation, structuring and planning of delivery processes;
- Establishing transparency;
- Management and leadership;
- Learning

The main contribution of this research is, in the larger perspective of the construction debate, a comprehensive review of literature on 'lean' and analysis and discussion of how the lean philosophy and its pivotal point of end customer focus can be meaningfully understood in relation to the context of construction. It is suggested that future research should examine the three following themes:

- Whole-life value and waste identification;
- Transparency regarding value/waste consequences of project and design decisions, and;
- Project delivery framework supporting lean application.

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