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Advancement of platform development in industrialised building

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Abstract

Demand for productivity in house-building is today causing changes of work methods in the building industry, for example by the utilization of house-building platforms. This requires development processes separated from those of individual house products. The aim of this study is to examine how platform development processes in the building industry are carried out and how product development theories fit to the studied context. A qualitative case study analysis shows how a house-building platform can be developed in a sequential manner with product development theories that could capture values from the construction company, property owner and from end user.

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Keywords: House-building; Iteration; Case study; Concurrent Engineering; Product Development; Construction

1. Introduction

Industrialised construction is often compared to the manufacturing industry, where focus has shifted from mass-production to a more market-oriented development process of new products (Johannesson et al., 2013). But there are major differences between the building industry and the manufacturing industry in the description of using predefinitions as support for efficient and product oriented processes (Gibb, 2001; Lessing, 2006).

The organisation surrounding a building project is often decentralised, which leads to a proliferation in methods and processes (Apleberger, et. al., 2007). When the building projects change from project orientation towards industrialisation with predefinitions, the methods for developing house-building platforms also need to change into one part that focuses on product development, and one part that is linked to the project specific detailing process

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(ibid.). Systematised theories of product development methods are described in the manufacturing industry but are lacking in the building industry.

The degree of predefinition of a product, or in this case a house-building platform, is based on how much of the product that is defined at the customer order decoupling point (CODP) (Johnsson, 2013; Gosling & Naim, 2009). A dominant part of the building industry is in the engineer-to-order (ETO) context (Gosling & Naim, 2009), which means that the customer can take part in the product specification process before any components have been produced (Johnsson, 2013). Pre-engineering of building components, layouts and sub-processes before order point, enables the customer to choose and configure the design and functionality based on platform definitions (Olhager, 2003). This can be achieved within an ETO context (Johnsson, 2013). The value of different strategies becomes central for the operational platform, measured in terms of cost development, quality improvements and lead times to customer and market (Brege et al. 2013).

Nevertheless is the house-building industry in a shift from project based construction to diversification of predefinitions in platform products in order to increase productivity (Jansson et al., 2014). To find efficient and reliable methods, knowledge about systematised development processes could be enhanced by analysing the house-building context to product development theories.

The aim of this research is to examine how platform development processes in the building industry are carried out and how product development theories fit to the studied context. This presupposes an understanding of how different values in the house-building platform contribute in the development process. Descriptions of methods that can be used for structuring the development processes are lacking which forms the reason of this study.

In order to fulfil the aim, the following research questions need to be answered:

- How could structures for product development contribute in the development of house-building platforms?
- How do different value perspectives affect platform development processes?

2. Frame of reference

Platforms provide a way of gaining benefits of volume while at the same time being able to offer products that can be individually adapted to each customer (Robertson & Ulrich, 1998; Thuesen & Hvam, 2011; Williams, et al., 2007). The complexity of platform systematisation in industrialised house-building does not stem from the work of defining the physical building system but from identifying a balance between predefinitions that provide customer value for the client and economies of scale in the diversity of product features (Voordijk et al., 2006). It has been shown difficult to identify general structures for supporting creative work for diversity of house products. Therefore it is important to separate the development of house-building platforms from the development of individual house projects (Jansson, et al., 2014; Lessing, 2006).

Jensen, et al. (2012) describe a house-building platform from three different views: engineering, customer and production. The engineering view is described by the technical platform in technical solutions and components (Lessing, 2006), the customer view by an architectural platform with architectural modules for technical, functional and aesthetic values (Wikberg & Ekholm, 2011), and the production view by the process platform with tools for supporting work processes (Lessing, 2006). Since each project in the building industry is unique regarding client demands and site conditions & regulations, it is difficult to have a fully defined house-building platform (Jansson, et al., 2014). Attempts (Jansson & Lundkvist, 2014; Bonev et al., 2014) have been made to evaluate how customer values, as for example functionality and variety, are kept in the development of house-building platforms. The results from these studies show that focus has been on reducing time and cost by using predefinition and routinized production rather than prioritizing customer values. When it comes to product development methods, the product oriented industry provides a pool of theories that are suitable to implement in different product development situations (Johannesson et al., 2013). Some methods are structured and some are based on intuition and experience. Studies have shown however that structured methods are positive for controlling the process and outcome of new product development (Graner & Missler-Behr, 2013). One way to structure a design process is by using an organised design approach (Pahl et al., 2007; Cross, 2008). This kind of approach can communicate a clear understanding of goals and work processes, and it supports interdisciplinary collaboration (Johannesson et al., 2013). Pahl et al. (2007) and Cross (2008) describe a general design approach from VDI-Richtlinie 2221 (1993) that