



Matching industrialised timber frame housing needs and enterprise resource planning: A change process

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Abstract

The potential for improvements in industrialised housing through the adoption of concepts like enterprise resource planning (ERP) from the manufacturing industry, as applied to small and medium-sized enterprises, is evaluated in this paper. Four single, consecutive case studies were performed at a Swedish medium-sized industrialised housing company. The findings suggest that ERP can meet industrialised housing needs as well as promote an organisation to be re-engineered through comprehensive change and act as a driver for a more efficient internal and external supply chain. © 2004 Elsevier B.V. All rights reserved.

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1. Introduction

The majority of one-family detached houses in Sweden have timber frames and are nowadays manufactured in permanent factories (approximately 74% between 1990 and 2002). By comparison, about 69% (down from 90% 20 years ago) of all housing starts in the US are stick built on site. From a market point of view, this indicates that an industrialised and process-oriented production approach could have potential for the whole housing industry. This is supported by an ex-

tensive governmental evaluation of the Swedish construction industry (SOU, 2000), indicating that it is possible to reduce production costs in housing construction through industrialisation, customer orientation, and a more efficient construction process. Logistics and supply chain management (SCM) are demonstrated (Agapiou et al., 1998; Naim and Barlow, 2003) as disciplines with the potential to increase efficiency in the construction process. In the large enterprise manufacturing industry, the supply chain concept has been one model for improvements in efficiency. Holistic production philosophies such as lean production, and comprehensive planning methods such as enterprise resource planning (ERP), which are supported by information technology (IT) based

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software systems, are used to manage parts of or the entire supply chain (Crowley, 1998; Tarn et al., 2002; Al-Mashari et al., 2003). The potential for improvements in the housing industry as well as the use of concepts such as SCM, lean production, and IT supported ERP, as applied to small and medium-sized enterprises (SMEs), motivate the research presented in this paper. The possibility of cross industry learning is discussed and analysed in two perspectives: from the manufacturing to the housing industry and from large enterprises to SMEs. The conclusions and outlines for future research are, together with an extensive literature review, based on the analysis of four consecutive case studies.

2. Production philosophies, methods and software systems

This section includes philosophies, methods, and software systems, i.e. the central concepts used by the manufacturing and the construction industries, to increase the effectiveness and efficiency in manufacturing and construction processes. A description of industrialised timber frame housing in Sweden is also included. Section two is also the theoretical framework for the analysis in section three. Based on similarities and differences of the concepts and the two industrial systems, the potential for cross industry learning is presented. The literature review, though broad, does not claim to be a complete foundation to entirely describe and analyse each concept. Instead, literature in the fields of construction management, economics, and supply chain was reviewed to properly match the purpose and research questions.

2.1. Production in the manufacturing industry

SCM can be viewed as the management and integration of key business processes across the supply chain, i.e. a process-based perspective (Ho et al., 2002). From a logistics and transportation perspective, SCM is seen as the management of materials, products, and information flow. It can also be considered as the simultaneous

integration of customer requirements, internal processes, and supplier performance (Tan et al., 1999). Effective integration of the major supply chain components, i.e. customers, manufacturing, and suppliers, is the key to an organisation's long-term success (Tan et al., 1999).

The concept of lean production, developed during the 1950s at the Japanese car manufacturer Toyota, resulted in economic benefits, a production system yielding higher product quality, greater possibilities of variation, and less use of resources as compared with previous production concepts (Gann, 1996). The lean production concept can be described as a holistic management philosophy, with product quality as the primary goal, which underlines the critical importance of employees, customers, improvements of the two main conversion processes, design and production, and elimination of all other activities, to achieve customisation of high volume products (Crowley, 1998; London and Kenley, 2001).

The theory of constraints (TOC) is a systems philosophy aimed at ongoing improvement of an enterprise that includes theoretical methodologies and tools focused on the organisation-wide aim (Mabin and Balderstone, 2003). Originally developed for production, TOC is now also applied to areas like finance and measures, projects, supply chains, marketing, and strategy (Blackstone, 2001). The implementation and use of TOC can improve the overall performance of a manufacturing organisation (Mabin and Balderstone, 2003). Meta-analysis (Mabin and Balderstone, 2003) shows improvements like reductions in lead and cycle times, inventory, financial improvements, and better customer satisfaction and team functioning due to TOC application.

Three elements defining ERP are identified in Akkermans et al. (2003), viz. a technical, a functional, or a business perspective. From the technical and functional perspectives, material requirements planning (MRP), manufacturing resource planning (MRP II), and ERP represents the development of methods and software tools for the planning and controlling of resources for manufacturing companies. To support a manufacturing company's business processes (mainly financial, manufacturing, and distribution), MRP,

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