TOWARDS A FRAMEWORK FOR ENHANCED ETO SUPPLY CHAIN PERFORMANCE

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ABSTRACT

ETO supply chains seem to exhibit natural barriers and resistance to continuous improvements. This paper aims to construct a framework to understand the links between Lean thinking, organizational learning and supply chain delivery capabilities in an ETO- context. The paper identifies the research gap between three specific research areas; ETO supply chains, organizational learning, and lean.

Keywords: lean, organizational learning, supply chain management, Engineer-to-order.

1. INTRODUCTION

An Engineer-to-order (ETO) supply chain is generally regarded as a supply chain where the customer order penetrates the design phase of a product. It is primarily associated with large, complex project environments in sectors such as construction and capital goods (Gosling & Naim, 2009) or shipbuilding industry (Mello & Strandhagen, 2011) but is also relevant for MTO companies offering customizations (Bäckstrand & Engström, 2017). The development of supply chain management theory and practice in ETO supply chains is still relatively immature when compared with other types of supply chains that produce high-volume products (Mello et al, 2017). Common is that ETO is often seen as a project or a one-time event, i.e. a temporary endeavour undertaken to create a unique product. The fragmented and temporary nature of ETO supply chains also contributes to the lack of knowledge transfer from one project to another (Jensen, 2017), hence hindering organizational learning and process innovations.

Due to the project-based nature of ETO-supply chains, several authors report difficulties with regard to adoption of lean management in these types of organizations (e. g. Powell & van der Stoel, 2017). However, organizational learning has recently began to emerge as the missing link to successful lean transformation (Engström & Käkelä, 2019). For example, Netland and Powell (2017) suggest that continuous improvement without learning is not lean thinking as such, this paper aims to provide a research framework that can be used for examining the important links between Lean, learning and supply chain capabilities.

2. THEORETICAL BACKGROUND

This paper covers three research areas; ETO supply chains, lean and organizational learning.

2.1 ETO supply chains

The ETO supply chain has emerged as a major supply chain structure and is set to become an increasing importance as more customised products are demanded across a range of industries (Käkelä & Bäckstrand, 2019). In general, ETO supply chains produce low volumes of a high variety of products and allow customers to demand products which are developed in order to exactly satisfy

their needs (Wortmann et al, 1997). ETO supply chains involve multiple companies performing diverse activities during a project, such as: design, engineering, procurement, manufacturing, assembling and commissioning and they are primarily associated with complex project environments in sectors such as heavy equipment (Elfving et al, 2002), construction and capital goods (Gosling & Naim, 2009) and shipbuilding (Mello & Strandhagen, 2011). However, recently it has also been identified that companies within other sectors and a general manufacturing strategy of Make-to-Order (MTO) can offer customizations as ETO products (Bäckstrand & Engström, 2017). ETO is differentiated from Make-to-stock(MTS), Assemble-to-order (ATO) and Make-to-order (MTO) using a concept called 'the customer order decoupling point' (CODP), see Figure 1.

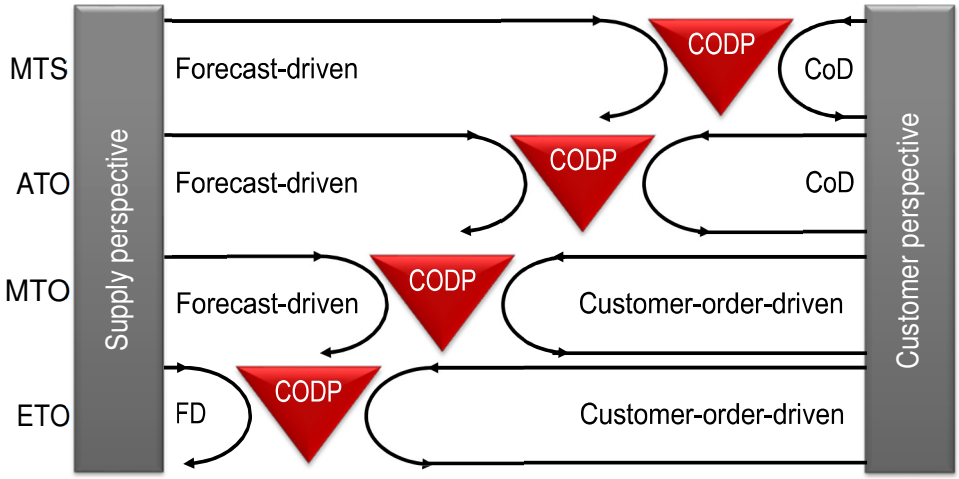

Figure 1. Different positions of the CODP, depending on the supply strategy (adapted based on Hoekstra and Romme,1992).

2.2 Lean

Since being popularized in the 1990s by Womack et al (1990), Lean has become the alternative approach to business management of the 21st Century. Lean promotes continuous improvement, employee engagement, problem-solving and supplier development. For example Netland and Powell (2017) suggest that lean, cut to the core, is about creating a culture for continuously improving the operations of a business or organization. They suggest that any lean transformation – regardless of sector or application area – is dependent on three essential Ls of Lean: Learning, a Long-term perspective, and Leadership. Since Liker (2004) highlights that lean involves *"becoming a learning organization via constant reflection and continuous improvement"*, and Ballé et al (2019) posit learning as '*the very heart of lean thinking*', we suggest that the field of Organizational Learning may present further insights necessary for successfully enhancing ETO supply chains.

2.3 Organizational Learning

Contradictions are the very fundament for learning in an activity system and depending on how they are handled, enabling or hindering, various types of learning in the organizations can be brought about (Gustavsson, 2007). Knowledge creation is built out of contradictions and on the interaction between the implicit and the explicit knowledge in an organisation (Nonaka, 1994; Ellström, 2010) Developmental oriented learning takes place when the implicit processes are made visible and transparent and results in reflective common agreements. The developmental learning is focusing on the innovative and exploring knowledge. Questioning of routines, trial and change of given ideas, knowledge and activities are essential (Ellström, 2010).

The knowledge learned by single individuals or teams needs to be stored and made available

for others in an organization. Organizational learning implies exploitation of the 'already known' to execute tasks in the most efficient way at the same time as the organization explores new areas of knowing and creates new knowledge to improve and renew the organization or the task performance. This balance between exploitation and exploration build on March (1991) understanding of organizational learning and is investigated in the growing research area of ambidexterity (O'Reilly & Tushman, 2004). This balance between exploration and exploitation can also be seen as fundamental to continuous improvement, the continuity of which requiring organizations to strike the balance between exploration and exploitation.

3. THEORETICAL FRAMEWORK

We suggest that in adopting a focus on both Lean and organizational learning, manufactures shall be able to enhance supply chain capabilities, such as to improve quality, cost and delivery performance, see Figure 2. This is particularly relevant for ETO-manufacturers which otherwise seem to exhibit natural barriers and resistance to continuous improvements.

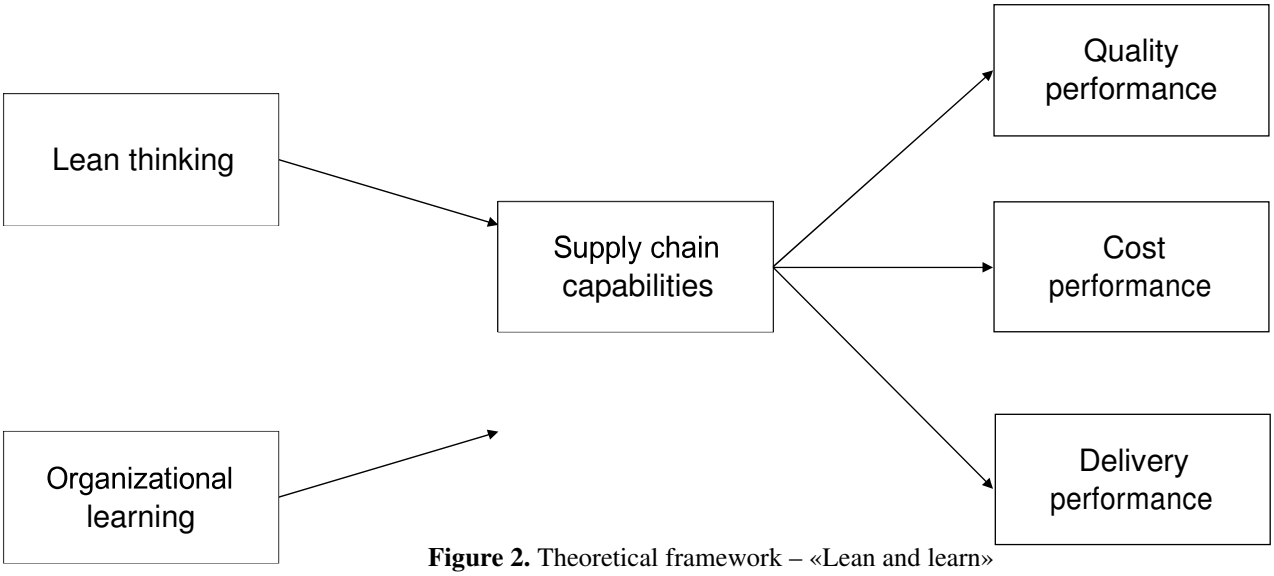

Figure 2. Theoretical framework – «Lean and learn»

4. CONCLUSION

This paper set out to develop and present a theoretical framework which can be further used to promote successful continuous improvement culture in ETO-manufacturers.

Drawing on important insights from both lean thinking and organizational learning, we present the "Lean and learn" framework for enhancing an organization's supply chain capabilities where an organization can be an individual firm, or more importantly, entail the whole supply chain to include important interfirm learning and collaboration. With regard to implications for practice, we suggest that organizations must switch the mindset that "lean does not work here as we are different" to a discovery and learning mindset where all opportunities to learn and improve are taken. Further research should apply and make practical observations of the lean and learn approach in ETO supply chains.

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