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ScienceDirect

Procedia CIRP 50 (2016) 179 – 185

www.elsevier.com/locate/procedia

26th CIRP Design Conference

Beyond waste elimination: Assessing lean practices in product development

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Abstract

Maintaining simultaneous focus on efficiency and effectiveness is a difficult yet necessary strategy to deliver commercially viable products in today's global world of competition. As a result, manufacturing companies aim to shift from a *modus of operandi* dominated by removing waste at the factory floor to leveraging value creation in all direct or indirect activities within the product value stream. One of the most popular strategies in this regard is to apply the Lean concept in product development (PD). This paper researches to which degree PD practices in a Scandinavian design and manufacturing company comply with Lean in its own context. A capability maturity tool has been developed and piloted in the case company to identify gaps and improvement potentials. The results show that the structure of the tool makes it scalable to other contexts than the case company.

Keywords: lean product development; value creation; assessment; company characteristics; improvement schemes

1. Introduction

1.1. Background

During the past decades, companies have implemented various countermeasures in response to increasingly competitive markets. Lean [1] is perhaps the most important concept that has been introduced to increase efficiency in manufacturing in modern times. However, lean production has undergone a shift from being a competitive frontier in its early days to become the present industry standard. Many companies have therefore established strategies for moving the lean concept beyond the factory floor and into Product Development (PD) [2,3]. However, PD is very different from manufacturing, and long-time discussions in the literature have yielded little progress in arriving at a unified understanding of Lean when this concept is being applied in PD. Even more importantly, there exist few documented examples of successful implementation of Lean PD, other than inside Toyota where the term *implementation* may be somewhat misleading.

Our hypothesis is that the basic nature of PD—its purpose, tasks, process, people and, last but not least, perception of value—makes the understanding and application of Lean very different from its counterparts in manufacturing. It is, therefore, a strong need in the research community to identify the characteristics of Lean PD, aiming to define a common starting point for implementation and continuous improvement as an essential part of any Lean strategy in PD.

1.2. Objective and scope

This research seeks to test a new tool developed to assess Lean capabilities at project team level. We use a hierarchical capability maturity model to investigate to which extent product manufacturing companies are engaged in Lean PD,

doi:10.1016/j.procir.2016.05.093

and the degree to which various Lean capabilities are implemented [4, 5]. The framework can be used as a means for gathering data about factors that influence Lean PD maturity levels to sustain competitiveness. We seek to build a basis towards a more contextual implementation of Lean in PD environments, than the one(s) associated with Toyota Lean. Aiming to use the framework for data collection in our research, an audit process has been designed using an interactive workshop with cross-functional PD teams.

A case study was conducted in a Scandinavian product design and manufacturing company with its R&D hub located in Norway. The assessment framework was used to identify contextual drivers and improvement scenarios related to Lean. The industry goal was to identify strategies for Lean transformation and continuous improvement, ones that support a more contextual implementation of Lean in PD.

The assessment tool is based on an explanatory Lean PD model consisting of six components: *Understanding of customer value*; *Knowledge transformation; Standardization*; *Stabilization*; *Continuous improvement*; and *Lean culture*, [4,5]. These components, their interfaces and interrelationships make up a system, which is believed essential to value creation in the value streams of any product-oriented manufacturing company. Hence, this system represents a basic premise for competitiveness in the short-term perspective. Without organizational learning, however, a competitive value chain alone is no guarantee that a company sustain competitive as markets, competitors and technology change. Thus the PD system must be structured to enable *strategic value creation* in terms of the knowledge flow and learning across multiple projects.

The assessment model is made scalable to different business contexts, using a three-level hierarchical structure, consisting of 22 underlying characteristics and 66 capabilities at the lower level. These capabilities are linked to a descriptive text that is anchored to a capability scale. Overall, they make up a capability maturity model for assessing leanness on project team level. The structure adopted is a traditional continuous grid method with origin from Quality Management [6] where all practices are scored to a different level, [7]. The developed framework was used as an interactive research tool to elicit knowledge about Lean PD practices in the case company. Two overall questions prevail:

1) How does the PD team rate their Lean capability maturity on an explanatory ordinal scale relative to the levels deemed necessary to sustain competitiveness?
2) How does context relate to the identified Lean PD capability maturity gaps?

To answer these questions, a semi-quantitative research study was designed and piloted in a Scandinavian design and manufacturing company. We use the explanatory Lean PD model and the derivative assessment tool as a research framework. As a starting point, we presume that capability gaps are mainly driven by (intra and inter) contextual factors influencing the operational practices in PD.

Although the Lean principles may have some universal applicability [8], a principle has limited value unless it is filled with actionable content. Therefore, the overall motivation for our research is to make a contribution towards more context-driven Lean PD implementation strategies. We presume that the capabilities for creating value are strongly dependent on *both* the microenvironment of the PD team and the business context of the firm.

The reminder of this article is organized as follows: Part 2 discussed the most fundamental part of any Lean strategy: understanding of value (and waste). Part 3 presents the fundament and the implementation strategy for the case study. The results from piloting the assessment tool in a Scandinavian design and manufacturing company is summarized in Part 4, and conclusions and further work are given in Part 5.

2. Understanding value in the context of PD

2.1. Identifying waste

The single most important factor in Lean is the understanding of value. In Lean production, value is said to be created if a specific operation or process step meets *all* three of the following requirements [9]: (a) The customer is willing to pay for (the result that leads from) the activity; (b) It transforms the physical shape of the object or product; and (c) It is done correctly first time. On the contrary, *waste* occurs when an operation fails to meet just one of these criteria. Waste is usually divided into two categories: Type 1 waste (‘enabling activities’) and Type 2 waste (‘pure waste’). Type 1 activities do not create direct value but are still necessary to support value creation, typically administration, management, mandatory testing, etc. Pure waste in production is commonly divided into seven (or eight) subcategories, including defects, over-production, transportation, waiting, inventory, motion and processing (and underutilization of people).

Depending on manufacturing process, its efficiency may be as high as 80–90 %. In product development, however, research indicate that the overall value-added time is less than 30 % in most companies [11,12]. The high waste (or better: *lack of value*) levels in PD (>70 %) are claimed to be mainly due to Type 1. To improve leanness in PD, therefore, companies should to a larger degree replace enabling activities with value-added time. On the contrary, hunting pure waste (Type 2) is a less viable strategy due to the nature of the activities and the typical characteristics of people involved. Unlike manufacturing, waste in PD is usually not a result of doing unnecessary activities but due to shortcomings in information flow and communication. Although each PD activity may be tangible in itself, in absence of a physical work-product, the quality and flow of information is mostly intangible. This makes it difficult to detect waste in due time through ‘quality control’ and complete ‘rework’ or ‘sorting’ before the ‘part’ goes to the next ‘operation’, and ultimately to the end customer. In addition, the concurrency and interrelated nature of PD activities could make a dramatic impact of any late detection or communication of wrong information in a performance perspective.

2.2. Identifying value

In a traditional production value stream perspective, the understanding of value is the most essential part of a lean