

# A Conceptual Model for the Implementation of Lean Product Development

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## ABSTRACT

Companies are faced with the need to address their product development challenges innovatively in order to stay competitive in today's market. One way of doing that is the integration of lean thinking in their product development process. However, due to the lack of clear understanding of the lean thinking performance measurements, the near absent of a holistic and unifying measuring method and the near or non-existence of an evaluating conceptual model to allow for the evaluation of the performance of the lean product development processes, many companies are unable to fully implement the lean thinking principle in their Product development process. In dealing with these issues, this article has therefore proposed a conceptual model which is based on some core critical success factors for the examination of lean performance in the product development process.

## KEYWORDS

Conceptual Model, Critical Success Factors, Lean Practices, Lean Product Development

## 1. INTRODUCTION

Lean thinking which is an improvement philosophy was first developed by the Toyota Motor Company, primarily to eliminate waste from the production system (Jaaron & Backhouse, 2011). However, in recent years, these thinking have been extended to other areas including the product development process. According to Paschkewitz (2011), applying lean thinking practices in new product development can help save the huge resources normally spent fighting sudden quality and reliability issues, it can lead to faster product development and cycle time, reduction in warranty costs, easier and cheaper manufacturing processes. Also, it can result in high-quality suppliers products since the suppliers are involved in the development process of the product, as well as increase sales due to reliability in the products by customers, and finally it can create an atmosphere and culture of doing things right the first time.

Despite the many benefits and high hopes in the lean strategy, many companies are still struggling, and unable to neither achieve nor sustain substantial positive results with their lean implementation efforts (Aikhuele & Turan, 2016b; Stenius, 2011). In the work by León & Farris (2011), they suggested that, one of the major issue affecting the efficient administration and implementation of lean product development practices in companies lies in the absent of a unified and holistic model for assessing the performance of lean product development practices and in tracking their progress as they seek to achieve efficient and effective lean product development process executions. Letens et al., (2011), claim the poor implementation of lean product development practices is due to the lack of clear

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understanding of lean practices and their characteristics. While Stenius (2011) concluded that, the lack of lean thinking when implementing lean is the main issue affecting the efficient administration and implementation of lean product development practices, and proposed a framework for the prioritization of lean development actions.

However, as the first step towards addressing these issues, this paper seeks to propose a conceptual model for the implementation of lean product development in an automotive related company by considering the Critical Factors for the successful implementation of the lean thinking practices in the product development process and to provide a guide for determining the underlying relationship between these factors and develop strategies for the successful implementation. The study is aimed at providing a roadmap for product development managers on the lean implementation route, and to assist them to lead their department as well as the entire organization to leanness.

This study technically contributes to process improvement of decision making, modelling, analysis of lean product development practices and the identification and analysing of the critical success factors for lean product development implementations.

The rest of the paper is organized as follows. The following section presents the literature review, critical success factors analysis and literature, the conceptual model and implication of the new model to Engineering Managers.

## **2. LEAN PRODUCT DEVELOPMENT FRAMEWORK**

Over the last two decades, several papers including the theoretical and practical aspects of the lean product development practices have been published, where some have focused on defining the lean product development (Hoppmann, Rebentisch, Dombrowski, & Zahn, 2011; Ms Khan & Al-Ashaab, 2013) other has concentrated on constructing implementation and support models and frameworks that include steps and tools for the implementation of lean product development practices. The focal point of some of models and frameworks has been the development of tools and operational components, the models and frameworks are reviewed here.

Furuhjelm et al., (2011), provides input to a generic Lean Product Development framework by defining an explanatory model for effective knowledge enhancement and execution of development projects. The model which consist of a two by two matrix, with value streams, Product Value Stream and the Knowledge Value Stream at one hand, product and the Concept phase and Implementation phase on the other hand serves as a basis for discussing how the Lean principles, Flow, Visualization, Standardization, and Continuous Improvement could be implemented. Wasim et al., (2013) develop a cost modelling system for lean product and process to support a proactive decision-making process as well as in the elimination of mistake in the design stage using lean enablers like the set-based concurrent engineering, mistake proofing (Poka-yoke) and knowledge-based engineering. Al-Ashaab et al., (2010) develop a conceptual model and its associated tools which are based on some core lean thinking enablers, which serve to provide knowledge-based user-centric design and development environment to support value creation to customers in terms of innovation and customization.

Nepal et al., (2011), through a reflective case study of a lean product development presented a lean transformation framework which was based on 13 lean principles of the Toyota Product Development System and it was implemented in a manufacturing firm in the US, using design structure and cause and effect matrixes for the analysis of the lean transformation and to determine the root causes of wasteful reworks in the company. Hines et al., (Hines, Francis, & Found, 2006) propose a six-step theoretical framework that they hope could serve as a reference point for academic discussion on the development of systemic approaches to the lean product development process, as well as for industry searching for a framework in their new product development process.

Letens et al., (2011), propose a multilevel framework which captures key lean product development principles at the functional, project, and portfolio levels; tools and practices for implementing the lean product development practices at each level; and also discuss the approaches for managing

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