

# Toward Adopting Lean Product Development: A Review

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## Abstract

*This research explores the concept of Lean philosophy applied to Product Development processes. In today's rapidly growing global economy companies need to continuously improve, and innovate their resources. Because customers expect better products and services all the time. Extant literature shows that product development has vast scope for improvement in small industries and lean philosophies can be a big boon for such industries in this context. The benefits of lean in product development are overlooked by many of the organization. The organizations applied lean into the manufacturing and logistics operations but the lean thinking have much more to offer in product development and life cycle management.*

## 1. Introduction

Understanding of the innovative performance of lean in organizations by the academic literature is immersive [1] and the topical state of affairs on lean product development is mentioned in the introduction to this paper form a diminutive subset of literature. In this context with that the latest literature on product development stated that organizational functional departments of organizations can be divided into two departments, one which deals with the product development and another which deals with the production of the developed product. And all other functional departments like Quality assurance, Purchase, Vendor development departments etc in an organization have the perspective to support these two departments. In these organizations product development department has to hand over the developed product to the Production Department so that mass production of that product can be started [2].

All production steps, processes and their sequence, their conditions and parameters are decided and documented during the product development [3]. The production department has only just to follow those processes as defined in the handover documents. This is extremely traditional

procedures which need to be modified because there is lots of waste involve in this procedure. The high rejection rate is high during development of the product [4] and sometimes it remains constant even after the production has started. A defect in product development can be resolved at much lesser efforts as compare to the situation when that same defect has transferred to the production. Great amount of time and money is used in the unnecessary, non valuable activities during product development process in organization. Thus the modification in product development is necessary and can be carried out by lean.

## 2. RESEARCH METHOD

Lean can be applied in product development processes to get better the effectiveness of product development department. And this paper is based on a literature review on lean product development. In this context a study on number of extent literature is carried out and important findings are observed which are being represented during this study. This paper does not claim to include everything that is concerned with the lean concept - that would involve a more wide ranging explanation than this. The purpose of this paper is to give literature review rather to give a holistic view of the concept, as it is described by previous researches. And before adopting the lean in product development processes it is important to completely understand the concept and objective of the lean technique by the organizations. In this sequence the origin of lean and its motive is discussed by many scholars. This research will discuss the product development (PDP) processes, lean concept the application of lean in PDP to get Lean product development (LPD) concept in an organization as lean and LPD are the enormous concepts that affect the entire organization. It starts with the Product development and then Lean and finally the application and benefits of Lean product development are discussed in light of literature.

## 3. Product Development

The development of excellent product not only opens new markets and attracts new customers, but

also influence existing assets and expand an organization's capabilities [5]. Product development is the blossoming field which keeps customers excited and hence increases the growth of an organization. The vast literature on new product success and failure reveal some factors that are critical to be a winner at this game [6]. Aggrwal [3] defines the seven phases of product development in his paper. These are:

1. Customer need analysis
2. Defining the design data
3. Selection of the Processes and Sequences
4. Making of Prototype
5. Testing and Evaluation
6. Documentation
7. Handover to Production

Product Development Processes (PDP) is extremely imaginative activities focusing on awareness and knowledge, distinct from the production systems of the organizations which primarily deal with the physical products and repetitive operational sequences. Product development is responsible for designing new products which meet customer requirements and expectations and which can be consistently and economically produced by manufacturing [5].

#### 4. LEAN

Lean was introduced in Toyota production System (TPS) which was known as first lean production system [7] and it involves the "supplanted" traditional production methods and delivery of goods and services [8]. This concept has driven a great interest of scholars throughout the world; therefore researchers have conducted a number of studies to examine lean philosophy. The literature on the lean concept primarily focuses on principles derived from manufacturing, especially the Toyota Production System [9].

As a technique, lean was introduced in production department in year 1990 [10]. And with the passes of time the definition of lean has been changed, it evolved the concept of waste elimination with those of the traditional philosophies. For example the waste involved in the phases of product development as discussed in [3] might be:

1. Wrong interpretation of customer need which leads to the dissatisfaction of customer,
2. Any error in conceptual design or in design analysis,
3. Error in evaluation, testing and
4. Defect in prototype

All waste involved in these phases should be minimized or if possible eliminated.

Kumar et al. [11] stated that the acceptance of lean practices is considered as a vital strategic tool for organizations to bloom. Relative assessment of leanness of the organizations has assumed central importance in the rouse of rising globalization and phenomenal development in technology. The organizations that have mastered lean manufacturing methods undisputed have extensive cost and quality advantages over those which are still committed to conventional mass production [12]. Here quality has been already defined by Deming as not only the product's ability to meet a customer's expectations, but to exceed them. Deming's philosophy starts and finishes with the customer [13]. Customer needs analysis should be accomplished methodologically during the product development procedure of an organization, and this will lead to the reduction in the problem probability related to quality when production of the product begins [14]. Only narrow efforts committed to evaluate the relative lean status of organizations have been made so far and there is an express requirement to eloquent a framework for measurement of lean adaptation.

Lean [15] emphasizes on total system efficiency. Conceivably, the best way to track lean development is total product cycle time that can be accommodated in a scorecard approach. Lean is not only a tool for minimizing cost, cycle time, or waste. Lean is a technique for maximizing values. In product development (PD), sometimes getting lean requires doing more, not less [16]. All organizations which implemented lean have gained a lot yet those who have gained the most, still, hold the lean principles, rather than just the tools and techniques used to implement lean once [17, 15]. Lean is a continuous achievement philosophy focusing on waste elimination by the help of any suitable tools and techniques.

Most of the research has studied the impact of relationship characteristics and facts of relationship management on product development e.g. [18-20] Stump et al. stated that involving the customers in product development is therefore considered as an important factor which highly impact on the success of product development [21]. This involvement of customers in new product development requires commitment not only from the customer but also from the organization [22]. The contributors and their applications in field of lean product development are tabulated below.

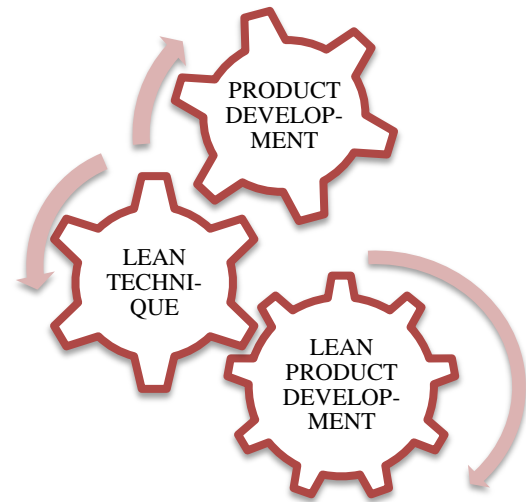
**Table 1: Applications of lean**

S.N.	Contributor	Applications/work
1.	Arnheiter and Maleyeff, (2005)	The primary tenets of lean management which should be included in A Lean Six Sigma Organization.
2.	Thomas et al. (2009)	Integration of LEAN with Six Sigma and map for implementation of Lean Six Sigma.
3.	Sawhney et al. (2010)	Developed Risk Assessment Value (RAV) to assess Lean risks, and Structured the modified FMEA approach based on RAV.
4.	Staatsa et al. (2011)	A attempt to implement a lean production system at Wipro
5.	Boyle et al. (2011)	Effect of management exposure to external information sources to management commitment to lean and the extent of lean thinking in organizations.
6.	Wang et al. (2012)	Development of a framework for LPD implementation.
7.	Rossi et al. (2012)	Five step Methodology to identify and measure wastes in NPD process, and to improve existing processes, under the lean perspective.
8.	Gurumurthy, A., and Kodali , R. (2012)	Utilization of Analytic Hierarchy Process for selecting a suitable PD Methodology.

## 5. Lean Product Development (LPD)

Lean Product Development is structure of developing the products in which lean techniques are used in product development processes in order to eliminate the waste. The LPD philosophy is sturdily a customer focusing concept which captures the voice of the customer and to define

and maximize the customer perceived value in the product of an organization [27].

**Figure 1: Origin of lean product development**

It is easier to implement lean in production/manufacturing than implementing it in product development, because the objective of minimizing the waste might put in danger the innovativeness and quality of the product development process. While lean might be an endearing technique when applied in manufacturing processes in order to improve them. Browning [28] discusses the way to increase the performance level and to reduce risk involved in that performance/ process. The purpose of product development is to create new value to the company, and the Lean principles should be used accordingly when applied to a development process. Continuous improvements are always part of product development strategy .There are several ways in which these changes can show up LPD is one of these ways.

The LPD concept includes many tools that can be used to accomplish this task. Looking at the product development process, the LPD concept promotes an integrated system with close collaboration and good communication between different functions and stakeholders this integration refers both to different process steps and to different functionalities within the same process step [8].

Lean product development has enormous prospective of improving development processes in the same radical way that lean manufacturing has enhanced the production in organizations [29]. The biggest prospective in the concept are the philosophies and how they can be adapted to suite the organization. Though in spite of covering a number of practices conducive to lean, they have only demonstrated how the basic tenets of lean can be used in PD process, describing the key characteristics that product development process should possess in order to satisfy the basic tenets and explained how the lean tools and techniques can help in achieving the same [30]. Fundamentally, by managing and improving processes, next to customer and employee relations, the economic perception would improve consequently.

LPD is a strategy which makes product development processes better, cheaper and faster, but several failed development projects have been noticed over a decade, where organizations demanding to put LPD into practice, have formed a cheaper and faster process, but not the better one [31]. Extant literature from [30] shows that the Lean principles has most often been used to increase effectiveness by eliminating waste, not by adding a new value. The major hurdles that an organization meets in attempting to apply lean in PD are a lack of direction, a lack of planning and a lack of adequate project sequencing. Knowledge of particular tools and techniques is often not a problem (Bhasin and Burcher, 2006).

## 6. Conclusion

Though Lean product development processes (LPDP) represent itself as a good way to reduce cost and create value, for eliminating the waste, yet LPDP is not only a method of reducing useless tasks and cutting costs. Moore [32] remonstrate that lean should not lead to redundancies and suggests that in over 300 companies engaged in cost cutting through layoffs only 45 per cent showed productivity improvements; 30 per cent showed profit improvements whereas 88 per cent experienced a serious decline in morale. That's why proper understanding of lean before adopting it in product development is necessary. While implementing lean some predefined values should be considered in product development as a way to motivate designers, managers, suppliers, and customers. The lean philosophy has delivered significantly economic benefits for organizations. Lean has shown that the time compression is also a gauge of quality, cost and customer satisfaction. The lean philosophy has delivered significantly economic benefits for organizations. Lean Product Development has great prospective of improving

development processes of an organization. Great achievement is noticed with the help of lean from different types of organization which deal in a wide range of products and services [33].

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