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Lean Product Development for Small and Medium-Sized Suppliers

Uwe Dombrowski, Alexander Karl

Abstract

Product development processes (PDP) in the manufacturing industry have been increasingly designed according to the principles of lean development (LD). This concept is based on the fundamentals of lean production systems (LPS) and was transferred into the specifics of PDP. Supporting this concept, numerous companies were already able to partially realize and anchor significant improvements in their PDP. In addition to these improvements, an enhanced relocation of individual tasks and activities in the direction of the suppliers can be continuously observed in the context of product development (PD). As a result, external development service providers and suppliers thus obtain considerable influence on the dimensions cost, quality, and time of PD. While the concept of LD is successfully adopted for the manufacturers, suppliers hardly or do not work at all according to these principles and methods. Recent studies show that these methods and principles are of limited use for suppliers. In order to generate similar improvement measures in other business processes, the concept was also transferred to other business processes, the concept was also transferred to other suppliers. This article pursues the question of how such a LD should be designed for small and medium-sized suppliers (SMSSes). For this purpose, the existing LD concept is explained, and the characteristics of SMSSes are highlighted. Supplier-specific requirements that need to be considered for SMSSes in LD arise from these characteristics. Suitable established principles and methods are to be included in the supplier-specific concept or, if necessary, adapted to changed requirements. The article’s aim is to develop and present a comparative concept, which highlights the differences and is specifically adapted to the SMSSes’ requirements.

1. Introduction: the continuation of lean enterprise

The business processes are subject to constantly growing and, to some extent, new challenges. Particularly the PDP as one of the core business processes is affected by these challenges, which result in changed process requirements. This circumstance applies e.g. to the increasing product variety through the individualization of customer requirements. In addition, the product life cycle is continuously shortened, as a result of which new products are generated and brought onto the market. In principle, the requirements can be summarized as follows: An ever-increasing density of product engineering and design has to be brought to production maturity with an increased development effort per product in ever-shorter time intervals. Furthermore, the subprocesses of PD are increasingly shifting towards suppliers along the value chain. [1].

In order to increase their competitiveness and to achieve improvements in terms of cost, quality, and time in spite of the increased requirements, different management concepts and philosophies have been established in business practice. One of these concepts is the lean philosophy developed from the Toyota Production System. While this LPS takes account of all business processes, its scope is limited to production. In order to generate similar improvement measures in other business processes, the concept was also transferred to other core and support processes. The transfer of the concept to PD can be mentioned exemplarily. [2] Meanwhile, in addition to production and PD, special lean concepts have also been established for other business processes, which are summarized as a holistic framework in the lean enterprise (LE). [3], [4]
1.1. The lean enterprise

The adaptation and transfer of the underlying philosophy allows companies to optimize the overall efficiency and effectiveness in terms of the company’s ecological, economic, and social objectives. The aim of the LE is not to optimize individual business areas in isolation, but rather to achieve a holistic coordination along the entire value chain. One of the main challenges faced by the LE is the coordination and linking of these individual lean concepts.

[3] All lean concepts are methodological rules for the comprehensive and continuous organization of business processes. The distinctive feature of the different concepts is the respective scope. [3], [4] Besides the lean PD system, the LE encompasses leadership and culture, the LPS, the lean sales and service system, and administrative processes. [4]

When looking closely, the independent concepts are very similar to each other because of their identical origin in the Toyota Production System. In some cases, an overlapping of the effective ranges is possible, particularly if the rules also contain indirect support processes. Despite the outlined similarity, some of the individual regulations have been subjected to extensive adaptations to the specific features of the application scope. A principle is a summary of related or linked methods and tools with regards to content through the different methods and tools of the rule set, so that a consistent overall system can be structured. [5] For example, the LPS as well as the lean development system (LDS) can be both used for a comparison. Five of the seven principles of the LPS can be also found in the LDS. More precisely, these are principles that are not linked to the specific area of production and which could be transferred to PD with minor changes. In addition, frontloading as a new principle has been added to PD. The originally separated flow and pull principles defined in the LPS have been merged into one common principle. [6]

Based on current research results, it can be assumed that the relevance of PD for the companies’ competitiveness continues to rise and is therefore significantly responsible for economic success. [1] Not only the quality of the products and the time until the start of production, but also the costs of product engineering and design can be decisively influenced by LD. Since it is one of the company’s most important core processes – but not comprehensively implanted into the company – LD will be analyzed in more detail. [10]

1.2. Lean development as a building block of the lean enterprise

The LDS is part of the LE and represents a company-specific directive (guideline) oriented towards the PD. The main goal of this guideline is the realization of a “value-oriented, resource-efficient, and fast” PDP. [22] In line with the LPS, this realization will have a considerable influence on the process, the management, and the value-added. Moreover, it will increase its efficiency sustainably and continuously. The LDS is based on different principles, which are described briefly below. [6], [7]

- **Avoiding waste**: The avoidance of waste is the foundation of all other principles and one of the main philosophies of the lean concept. Different types of waste – e.g. in the form of unused resources, neglected scale effects, lack of customer orientation, or generally unnecessary working steps – should be minimized and, if possible, completely eliminated. [7], [8]
- **Kaizen**: Kaizen, also known as the continuous improvement process (CIP), is a system for the continuous critical reflection of all existing processes in order to achieve continuous improvement. The background of this principle lies in the core idea of the incessant striving for perfection. [7]
- **Standardization**: Structured workflows and clear responsibilities for all employees are intended to minimize improvisations and the associated waste. Standardization should not restrict creativity in the PD because the established process can impair the company’s ability to innovate. [7], [9]
- **Visualization**: Visualization is about the transparent representation of information flows, processes, and resources. It is used to simplify the identification of waste. [10]
- **Flow and pull**: The principle follows a continuous course of the process – similar to a “thread” – through the entire value chain in order to generate a fast, continuous, and turbulent flow of materials and information within the framework of PD. [7]
- **Zero-defects**: This principle is aimed at minimizing errors through quickly identifying and correcting mistakes by means of a targeted error culture of
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