

LEAN PRODUCTION – CONCEPT AND BENEFITS

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Abstract: *This paper presents in a general manner the concept of Lean Production and the benefits of its adoption. Lean production is a term met more and more nowadays, a strategy being in a continuous development, based on a set of principles and tools to achieve its objective: to eliminate waste in order to improve an enterprise's performance.*

Keywords: lean production, principles, tools, benefits.

JEL Classification: M11.

1. Introduction

In the late 70's, the U.S. companies had a strong interest in the NC machine tools and in the advanced automation as well as in planning the materials necessary for the production process. (Mabert, V.A., 2007). Womack, J.P. et al. (1990) in *The Machine that Changed the World*, uses the term Lean Production in contrast to the mass production system of the West. The Japanese companies focused on applying the Lean Production principles, using relatively simple technologies and lower costs automation at the expense of the computer technology.

The concept of Lean Production is based on the Toyota production system (Spear, S. & Bowen K.H., 1999; Womack, J.P., Jones, D.T. & Roos D., 1990). The Toyota production system focused on reducing waste, considering all aspects of the production process, using a variety of techniques and tools for eliminating waste, such as: just-in-time, cellular manufacturing, Value Stream Mapping, 5S, kanban (pull) systems, Kaizen, synchronous manufacturing, Poka-Yoke, (Bicheno, J., 2000; Rother, M. &

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Shook, J. 1998), which resulted in a decrease of stocks and of the execution time, an increase of the delivery performance, a rational use of space, a better resource utilization and an improved productivity and quality (Pavnaskar, S.J., Gershenson. J.K. & Jambekar, A.B., 2003).

2. The Lean Production Concept

Lean Production can be defined as a philosophy or as a strategy which depends on a set of practices used to minimize waste in order to improve an enterprise's performance (Womack, J.P., Jones, D.T. & Roos, D., 1990). Lean Production comes from the Toyota production system, a concept adopted by many major companies across the world in an attempt to remain competitive in an increasingly globalised market. (Pérez M. P. & Sánchez A.M., 2000; Hosseini Nasab, H., et al. 2012, 73-81)

Since the first use of the concept, there have been some attempts to define the term Lean conceptually (Lewis, M.A., 2000; Hines, P., Holweg, M. & Rich, N., 2004; Shah, R. & Ward, P.T., 2007); unfortunately, the definitions are vague, and the lack of a clear definition leads to communication difficulties (Boaden, R., 1997) and difficulties in implementing the Lean Production concept in enterprises as well as in establishing its precise objectives (Andersson, R., Eriksson, H. & Torstensson, H., 2006). Parker (2003) considers that, due to the so many different conceptual approaches of the Lean term, it becomes difficult to identify the real benefits of its use. The lack of a precise definition makes it difficult to establish if the changes occurred within a company are or not in accord with the principles of the Lean Production, which leads to a laborious evaluation of the efficiency of the concept. It is therefore necessary to estimate the success of the Lean Production before implementing it, in order to avoid wasting time and money (Pettersen, J., 2009, 127-142).

In an attempt to define Lean Production conceptually, we can say that it uses the just-in-time practices and aims at the rational use of resources, the strategies to improve the production process and the elimination of waste, and the use of managerial scientific techniques. It is, however, difficult to formulate a complete definition encompassing all the elements of Lean Production, which is in a constant development. Thus, today's definition reflects the current image, which at some point in the future will no longer be valid.

3. Lean Production: Principles and Tools

Lean Production includes, on the one hand, a strategy which depends on a set of tools and, on the other hand, the Lean thinking, which focuses both internally by reducing costs, and externally to increase customer satisfaction.

The objective of this multi-dimensional approach is the reduction of costs by eliminating the non-value activities, using tools such as just-in-time, cellular manufacturing, Value Stream Mapping, 5S, kanban (pull) systems, kaizen (Bicheno, J., 2000; Rother, M. & Shook, J. 1998; Kocakulah, M.C., Austill, D.A. & Schenk D.E., 2011), total productive maintenance, production smoothing or production levelling, setup reduction for waste elimination (Abdulmalek, F.A. & Rajgopal, J., 2007; Scherrer-Rathje, M., Boyle, T.A. & Deflorin, P., 2009). The implementation of the efficient production practices based on the flow optimization is expected to lead to better operating results, using, for example, an inventory leanness (Hofer, C., Eroglu, C. & Hofer, A. R., 2012), which—in turn—should enhance the enterprise's performances (Cuatrecasas-Arbos, L., Fortuny-Santos, J. & Vintro-Sanchez, C. 2011).

The literature emphasizes the fact that the Lean Production is mainly based on the just-in-time production. The just-in-time method consists of an elaborate planning of the production process and the amount of raw materials required are used exactly where they are needed, resulting thus a reduction in the stocks of raw materials and parts. In each stage of the production process only the amount needed must be obtained and it should be done only when it is required by the next working stage, according to the technological flux.

Value Stream Mapping is a Lean Production tool, used to design and analyze the production process. It is designed to create an easy way for managers to visualize the value flow. The value is defined as that thing which brings a product in the form desired by the customers who are willing to pay for it (Kocakulah, M.C., Brown, J.F. & Thomson, J.W., 2008). The goal of the Value Stream Mapping is to help managers identify waste in all their processes in order to eliminate them: the waste time of the production process resulting from a faulty organization of the working equipment (motion), waiting, the time spent on handling the products from one stage to another of the production process, from the production workshops to warehouses (transportation), a production larger than it is required for the

next stage of the production process (over production), the undesirable characteristics that affect the product functionality or its appearance, the refuse (defects), over processing, inventory.

Another basic tool for the managers who want to adopt Lean Production is the 5 S. The 5 S has its origins in the Toyota system and refers to the words that describe the steps to be completed for each stage or phase:

- seiri – separate – is the first step that consists in eliminating all that is not needed to complete the tasks.
- seiton – sort – identifying the stages of production and the elements necessary for the performance of the tasks required in those stages, which are organized in an optimal manner in order to avoid wasting time on handling.
- seiso – sweep – everything must be kept clean and the production scraps and refuse should be removed.
- seiketsu – standardize – standardization of processes through efficient organization of the working equipment while programming them in order to have maximum efficiency.
- shitsuke – sustain – the final step consists in consists in maintaining cleanliness and order every day.

The 5S program has a number of benefits, such as: maintaining discipline, reducing production and handling time which leads to lower costs.

Cellular manufacturing is a Lean method which is based on the group technology principles. The workstations and the equipment are organized in order to allow easy transition from one stage of production to another, resulting a minimal handling of materials, greater speed of working, eliminating unnecessary costs and having reduced stocks

The **Jidoka** principle is a process of quality control and refers to the automation of the functions of the production supervision, which means that the personnel is warned in case of an abnormal situation in order to stop the production line, thus preventing wastage, refuse and an additional output, focusing the attention on understanding why the problems occurred and how they can be avoided in the future.

Poka-yoke refers to any mechanism that helps staff to avoid errors. Its purpose is to eliminate product defects by preventing, correcting, or drawing attention to human errors.

The Lean concept is criticised in the literature from the perspective of the personnel, because this side is less known, focusing primarily on techniques for improving the performance of the system.

Jidoka and Poka-yoke suggest that employees can not be trusted in order to have good quality products, creating a need to eliminate the possibility of human error in the system.

Kanban is a stock control system, and it is usually performed by the FIFO method. Kanban is an effective tool which contributed to the functioning of the production process as a whole. Sugimori (1977) stated that the Kanban system has many advantages over computer technologies, such as: reduced cost of information processing, it is easy to obtain and transmit information in a dynamic environment, the demand for materials is judiciously sized. Sugimori criticized the lack of respect for the human being of the enterprises whose production was controlled by computer systems. The Japanese consider the Kanban system more transparent, allowing staff to understand the production process without the need to use complex software.

Womack and Jones (1996) identified five principles of the Lean Production, in order to implement the concept in different industrial branches: the value is determined by the point of view of the customer (Customer Value), Value Stream, Flow, Pull and improvement. Womack and Jones (1996) consider Value Stream as being specific products with specific qualities offered at special prices through a dialogue with specific customers (www.bath.ac.uk).

The Value Stream term is often used within the Lean Production concept and it is defined as a set of specific actions required to produce a given product, based on the three management tasks: the task to solve all the problems starting from the concept through a detailed design to the launch of production; from order taking, through detailed planning, to delivery and physical transformation of the raw materials into a finished product ready to be handed to the customers. (Womack, J. & Jones, D.T., 1996) The goal is to identify the inefficient activities of the process and to eliminate the waste.

Flow – Cellular manufacturing is adopted by the enterprises that use Lean Production, where each module has all the necessary resources to manufacture a product, or, if several modules are organized in order to produce a certain product, in order to obtain a production process by which the product smoothly goes through all its stages until it reaches the final user, the client.

Pull – Hopp and Spearman (2004) defined the Pull system as one that explicitly limits the quantity of products entering the production process. The traditional production methods tend to Push products in the manufacturing process, without limiting their quantity in the hope that it will be a customer to buy the already made products. In a Pull system not

even one single production stage will be finalized until there is a demand for moving to a later stage.

Once businesses adopt the Lean principles, the improvement of processes is certain. Another principle of the Lean Production concept is the continuous improvement, so that reducing efforts, costs, space used, and production time can be continuously achieved.

4. Benefits of implementing Lean Production

The Lean Production concept has been developed for many years and it is often considered the most important strategy that can be adopted by the manufacturing companies that wish to obtain global performance (Rinehart, J.W., Huxley, C.V. & Robertson, D., 1997). It presents a number of benefits (Figure 1), such as (Melton, T., (2005):

- A reduced delivery time;
- Reduced inventory;
- A better management;
- Less rework.

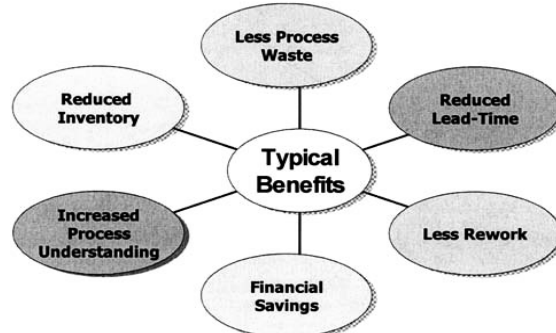


Figure no. 1. Benefits of Lean Production

Source: Melton, T. (2005). The benefits of lean manufacturing. What lean thinking has to offer the process industries. *Chemical Engineering Research and Design*, 83(A6), 663.

5. Conclusions

The changes in the business environment in recent years have made the term Lean to be used more and more. Lean Production is a concept that

knows a constant development, so the today's attempt to formulate a definition of this concept will reflect a real contemporary image, which at some future point will no longer be valid.

It is obvious that the adoption of the Lean Production principles will improve the entire process of production, the purpose of this strategy being that of reducing costs by eliminating waste and by increasing customer satisfaction, increasing thus the performance of the business.

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