

LEAN CONCEPT APPLICATION IN PRODUCTION BUSINESS

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Preliminary notes

Strong competition and continuously changing market demands require constant change and improvements of a company's business. For production companies, it is very important to keep their production processes efficient by constantly improving them. In this paper the production management process approach is presented, as well as the fundamentals of Lean production. Value stream mapping has proved as one of the efficient tools for the analysis of production. Application of this tool for the analysis of waste in production process is presented in the case study.

Key words: *Lean management, process efficiency, production processes, value stream mapping*

Primjena Lean koncepta u proizvodnoj djelatnosti

Prethodno priopćenje

Velika konkurencija i stalne promjene u zahtjevima tržišta zahtijevaju od poduzeća stalnu promjenu i poboljšanje poslovanja. Za proizvodna poduzeća jako je važno zadržati poslovne procese efikasnim, na način da ih se kontinuirano poboljšava. U ovom je radu prikazan procesni pristup upravljanja proizvodnjom te su dane osnove Lean proizvodnje. Kao jedan od efikasnih Lean alata za analizu procesa proizvodnje pokazao se alat Mapiranje toka vrijednosti. Na primjeru iz prakse pokazano je kako ovaj alat može biti koristan u analizi gubitaka tj. rasipanja u proizvodnom procesu.

Ključne riječi: *efikasnost procesa, Lean management, mapiranje toka vrijednosti, proizvodni procesi*

1

Introduction

Uvod

Like never before on the world market, strong competition demands from the companies continuous improvement of their business and production models. Low costs, high quality, short delivery time and production flexibility are a precondition for retaining a stable position on the demanding and unsecure market. The existing crisis which overtook almost every production branch, urges the companies' managements to make fast and efficient changes in order to survive on the market.

There are many production models, methods, concepts and tools which could significantly improve a company's business. Business results of the Japanese companies like Toyota, Nissan, Honda, Panasonic and others, show that Lean production is a concept which can considerably increase efficiency, innovativeness and competitiveness of Croatian production companies.

In this paper the concept of Lean production is elaborated and explained. In its integral approach it represents a group of very useful tools and methods. A short description of the implementation of the Lean concept in a production company is also presented.

2

Process approach in production management

Procesni pristup u upravljanju proizvodnjom

Contemporary companies exist under the influence of many factors which come from the outside environment and also from the inside. In order to promptly respond to market challenges, company has to improve the quality of its products, processes and work on continuous development of its workers.

Business process is a set of business activities, combined together in one unit with the purpose to create

added value to a customer.

Elements of every process (Fig. 1) are: available resources (inputs); activities, indicators of success, orientation toward customer (outputs), the process's owner and information [1].

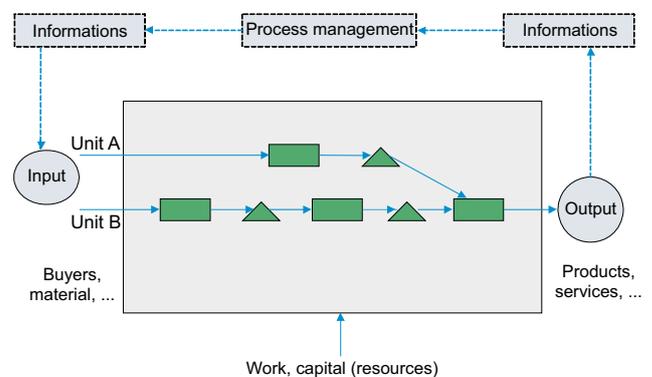


Figure 1 Characteristics of the process [1]
Slika 1. Karakteristike procesa [1]

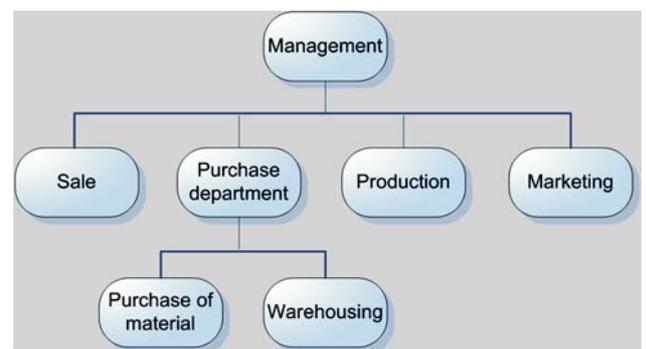


Figure 2 Traditional approach in managing the processes
(focus on the production functions)
Slika 2. Tradicionalni pristup vođenja procesa
(fokus na proizvodne funkcije)

Contemporary approach to the company's leadership is based on the support of information technologies and continuous improvement of all kind of processes.

Today, most of the companies organize their business based on the traditional functional organizational structure (Fig. 2) as opposed to the contemporary approach based on business processes (Fig. 3).

In order to transform the functional approach to the process approach the first step is to know and understand the company's process, which includes the following steps:

- 1) Analysis of business activity and defining current processes
- 2) Analysis of current processes and their elements
- 3) Proposal of changes in current processes
- 4) Implementation of adopted changes – new way of running the processes in company.

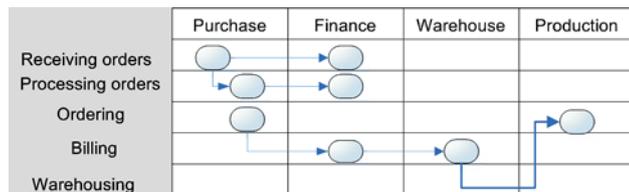


Figure 3 Process approach in process management (focus on activities in the company)

Slika 3. Procesni pristup upravljanju procesom (fokus na aktivnosti u poduzeću)

3

Fundamentals of Lean production

Osnove Lean proizvodnje

The basic idea of Lean production is "make more with less resources spent (just exactly as needed)". The term "Lean" is the opposite of the principles of mass production which for a long time has been dominating in western industry denoting big production systems with huge stocks, big batch production, downtimes, and waitings in production process.

The concept of Lean production comes from Toyota, and their production philosophy. This Japanese Manufacturing philosophy was explored by International Motor Vehicle Program, an international research consortium founded by the Massachusetts Institute of Technology in order to identify trends in the global automotive industry. As a result of their benchmark study of the world's biggest car manufacturer, *The Machine*, a book that changed the world was published, underlining the competitive advantage of the Japanese manufacturers.

The scientists from prestigious American universities have defined five principles of the Lean concept, which, along with the Toyota's seven wastes, provide a framework for managing production based on Lean production [2 and 3].

1. Understand what the customer wants to buy and provide full service and satisfied customer. This principle emphasizes the importance of producing a product which will be valued by the customer and for which the customer is willing to pay. This principle also explains the importance of removing the waste from the processes. Waste is considered as any activity in production system which stops or extends the process of transforming material/information into money.
2. Define the flow of material and all activities from ordering to delivering a finished good to the customer.

After defining what and how to produce, it is necessary to analyze all flows (from supplier to the customer) in order to identify and eliminate waste from the process.

3. Enable flow of the product. It means the flow which will provide delivery of the product without delays, waiting or any other disturbances.
4. Adjust the production to the level of demand. When it is not possible to completely define material flows (because of the number of customers, technology, etc.) it is necessary to stop the production properly in order to readjust the customer's order. In that way, it is possible to accomplish all customer's demands and needs in every stage of production process.
5. Strive for perfection in every aspect of business and in relationship with customers and suppliers. This principle emphasizes the importance of team work in the company. Teams have to be formed at all levels of the company with the goal to solve problems on a daily basis.

4

Lean glossary

Lean terminologija

Lean, as every other concept has its own glossary. There are many terms used in the Lean production concept, and some of them will be used in this paper, so it is important to explain them [4 and 5]:

- Value stream – indicates all activities in production system, both value added and non value added, that are currently necessary for the flow of the product and the information through the production process.
- Value – it is a key term in the Lean production and it should be defined only from the customer's perspective. Hence, it is extremely important for every company to understand what the customer wants and from that perspective define the value.
- Value-added activities time – VAT – time of all activities that add value directly or indirectly, from the customer's point of view, and for which the customer is willing to pay (machining, transforming material, assembly, painting, etc.). These activities are considered as pure profit and the goal is to maximize their part in the whole process.
- Non-Value-added activities time – NVAT – time of all activities that don't add value to the product or the service, but are necessary for the smooth flow of production (transport, quality control, etc.).
- Waste – Toyota has defined seven major types of waste: overproduction, waiting, excess inventory, defects, unnecessary transport, overprocessing, and unnecessary movement.
- Waste time – WT – time of all activities in the value stream which, from the customer perspective, don't add value to the product or service and could be eliminated from the process without any major influence on production flow. They are considered as pure waste.
- Process cycle efficiency – PCE – it indicates the portion of VAT in total production time:

$$PCE = \frac{VAT}{VAT + NVAT + WT} \quad (1)$$

4

Definition of value and Value stream

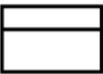
Definicija vrijednosti i toka vrijednosti

Regarding the Lean production, value is considered as characteristic relating to specific product or service which fulfils the requirements set by the customer. Company has to design and produce the products that will be accepted by the customer and that the customer will be willing to pay for. Every activity in the value stream should add value. Thereby the defined value presents the fundament of successful production.

Flow of information and material in the Lean concept is called Value stream. That flow of information and material is initiated by certain inputs. Those inputs could be ordered from the customer or work order. Value stream is the flow of all activities (both the activities which add value and the activities which do not add value) necessary for the work order to be realized. Thus, it is very important to understand value stream for improvement of any production system. Understanding of value stream means consideration of the whole company, not just optimization of specific parts. Flows in the company could be presented by graphs which visualize both the flow of material and the flow of information. Those graphics are called value stream maps. Mapping is the activity which includes and drafts all parts of the process and the flow of every activity in the observed process.

There are two types of maps. The first one is current state map, and the second one is future state map which presents improved state based on utilization of the Lean tools and principles [6].

*Table 1 Value stream mapping symbols
Tablica 1. Simboli kod mapiranja toka vrijednosti*

Symbol	Meaning of the symbol
	Process
	Stock
	Worker
	Electronic flow of information
	Regular flow of information
	Transport
	Kaizen opportunity
	Pull arrow
	Push arrow

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Implementation of Lean production in production company

Implementacija Lean proizvodnje u proizvodnom poduzeću

The first step in the implementation of the Lean production is to draft the current state of the process, because something that is not defined and measured cannot be improved. After mapping the current state, this current

state is analysed and the opportunities for improvements defined. These improvement opportunities are marked in the map as "Kaizen opportunity" and they are often accomplished through "Kaizen events". Kaizen is a Japanese word which is translated as continuous improvement, and in the lean terminology the phrase "Kaizen events" implies one-time effort involving different stakeholders [4]. As mentioned before, Value stream mapping, the tool for drafting the flow of materials and information from the customer's order to the delivery of a finished good, has proved a very useful tool for the current state analysis Value stream mapping uses specific symbols so the maps can be understandable to everyone. These symbols are shown in Tab. 1 [6].

6

An example of the application of the Value stream mapping in the production company

Primjer primjene mapiranja toka vrijednosti u proizvodnom poduzeću

The purpose of the value stream mapping in the company was to analyze high voltage pylons production, in order to define all the activities, better understand the processes and identify where the waste occurred within the production process.

This company is a low volume, high-mixed production company. The core business of the company is production of high voltage pylons. These products bring most financial benefits to the company. The company was faced with problems regarding quality (missed or defect parts) and late deliveries. Management of the company decided to identify the reasons why these problems occurred so as to improve the productivity. In order to visualize the production process and to identify where the waste occurred the Value stream mapping tool was used and the waste in the process analyzed (Fig. 4).

*Table 2 Waste in production of high voltage pylons
Tablica 2. Gubici u proizvodnji dalekovodnih stupova*

Num.	Waste identified	Description
1	Transportation	Too long transportation layouts due to bad equipment layout
2	Waiting	Waiting for material from storage. Waiting for documentation, while the work order is already in production
3	Stock	Huge quantities of raw materials and finished products in warehouses
4	Unnecessary motion	Workers looking for material, going for tools or material to storage, material handling
5	Defects	Errors in production
6	Underutilized people	Workers waiting for job to do

7

Current state analysis of production process

Analiza trenutnog stanja proizvodnog procesa

The overview of the observed waste in this example is shown in Tab. 2. This systematization was made according to the Toyota's seven wastes: overproduction,

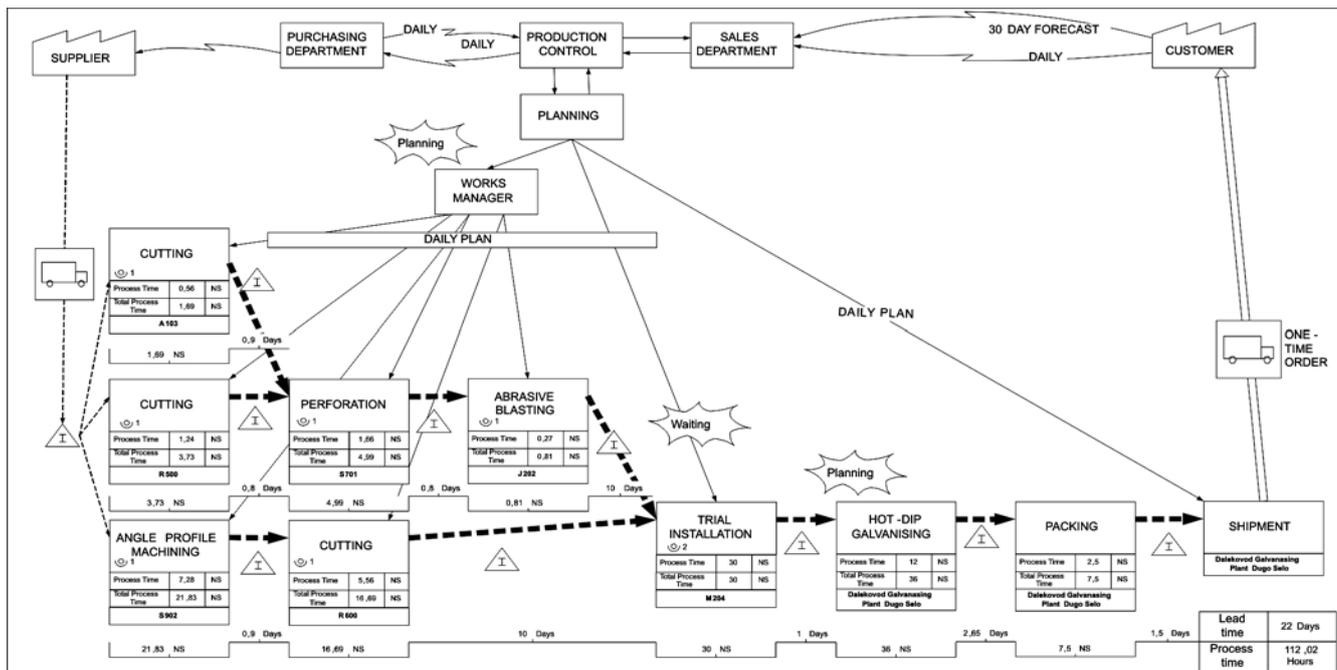


Figure 4 Current Value stream map of high-voltage pylons production
Slika 4. Mapa trenutnog stanja proizvodnje dalekovodnih stupova

transportation, waiting, inventory, unnecessary motion, defects and the additional eighth type of waste, underutilized people. The waste was identified by insight in the production process and by analyzing the current state map for this specific product.

Besides the waste summarized in the Tab. 2, some other problems were observed in production area such as planning and scheduling, WIP (Work In Process), communication between departments.

8 Improvement suggestions

Prijedlozi poboljšanja

The current state of production showed as not too efficient, due to the amount of different waste in the process and lack of communication between departments. As a result of this study several improvement measures could be recommended:

- Elimination of waste summarized in Tab. 2. Thereby the lead time will be shortened and the production process will be more efficient.
- Application of 5S tool, thus the work environment will be more organized and safer.
- Introduce the Kaizen events as an efficient way to give all workers the opportunity to analyze and improve the whole value stream.
- Recommend to the Top management to consider introduction of the Lean production into the company and to support and be involved in its implementation.

9 Conclusion

Zaključak

Value stream mapping is a Lean tool which has proved to be very useful for analyzing processes. In this paper the implementation of the Value stream mapping is shown as an efficient way for identifying all types of waste in production

process. This project is expected to be continued so that the future state will be proposed in the second phase together with the action plan for achieving this state, with the tools, responsible persons and deadlines defined.

10 References

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