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LEAN Production issues in the organization of the company - the first stage

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Abstract

Today's market determinants and most importantly, very dynamically changing customer requirements significantly shortened the product life cycle. This situation reflects in companies by common extension of the assortment offered and personalised serial production. The result of a flexible approach to market changes is the implementation of LEAN concept, which, both in terms of management and production aims to develop efficiency within an organisation, which will then enable quick and dynamic response to changes in the environment. The popularity of LEAN concept (in management and production) among managers comes from its universality and a wide range of instruments used to maximise the use of existing potential. The main assumptions of LEAN concept are aimed at the maximum use of an organisation's resources, defining the activities necessary to execute an order and identifying the areas generating losses and then minimising them and eventually eliminating. LEAN concept is based on flagship-main tools for identification and modernisation of processes, the difficulty in using them results from the need to recognise and select the most effective ones that meet the expectations of a given organisation. The article presents issues related to the first stage of implementing LEAN concept in a company's structures, i.e. identification of opportunities and selection of appropriate tools.

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1. Introduction

LEAN Management is currently one of the most popular concepts of business management, based on a multi-criteria analysis and re-organisation of the production system. The essence of LEAN philosophy is "slimming down" the company through thorough changes in its structure, aimed at both reducing costs, shortening production cycles, as well as increasing the quality level and acquiring new customers. This approach to business management is characterised by the necessity of detailed identification, analysis and, effectively, shaping business (production) processes. This forms the basis for understanding the patterns of operation in selected areas of the company's operation (Szatkowski, 2014; Urbaniak, 2010).

The effectiveness of using the company's resources (especially in the opinion of owners and managers of small and medium-sized companies) becomes of key importance for further functioning and development of companies in the competitive market. The study presents a set of instruments

that can be used to improve processes in technical, business and organisational areas. Particular attention was paid to the first stage of entering the analysis, i.e. identification of principles in the company's operation and searching for suggestions of actions that would improve the organisation of processes. The applied identification of crucial points of the process map value stream allows to determine the areas and necessary tools (techniques) of LEAN concept aimed at eliminating wastage and increasing efficiency (Bhasin and Burcher, 2006; Mann, 2005).

2. Tools and techniques

For the first time, the name Lean Production was used to compare parameters (inputs and effects) of production systems for Japanese, American and European companies. It was then that comparison of the obtained results recognised Japanese company Toyota Motor Production as the leader in the effective organisation of production. This system was referred to as LEAN as the first one and became the basis for

organisational changes to obtain better performance indicators (Aoki, 2013; Womack and Jones, 2002). The main principles of creating new, slim structures of enterprises were: elimination of wastage (unnecessary processes and activities), maintaining reliability of equipment used in production, reliability of manufacturing processes (elimination of quality deficiencies), single-stream flow, inventory reduction during production processes, shortening the time of serial orders - acceleration of supplies, corrective actions in material processing processes, Kanban system, principles of process and operation standardisation, work visualisation, control over production, production levelling (Heijunka), production cycle, short time of retooling of production equipment, re-organisation of positions to reduce transport processes, use of outsourcing principles. All these principles form the basic guidelines for searching for the possibility of changes aimed at slimming the system down in order to increase the effects of materials, energy, information and absorption of employee potential management (Liker, 2005; Hines et al., 2004; Resta et al., 2015).

LEAN concept has been used in production, hence there are several terms related to this matter, i.e. Lean Manufacturing or Lean Production. These terms are used interchangeably with the Lean Management concept. Generally speaking, Lean Management means striving for maximum slimming down of a company in the areas of management, production and administration. The message LEAN carries is elimination of all kinds of wastage, limitation of the company's internal functions to the necessary activities, and also with regards to production processes - limitation of any steps that do not lead to product's increase in value. The concept of "lean management" was defined as a set of principles, procedures and standards relevant in the production process of enterprises. At the same time, it recognises the need to apply further instruments that form the basis for improvement changes at all stages of production (Womack and Jones, 1996; Womack and Jones, 2003).

LEAN concept that uses a combination of different instruments is a solution that allows for a creation of a flexible system that will be able to dynamically react to changes taking place within the organisation and in its environment. Implementation of the concept in the structure of an enterprise requires continuous improvement of the organisation through numerous employee training, and the division of responsibilities through separation of small organisational units or teams working on a specific task. The condition for the proper course of the transformation process is their appropriate grouping, establishing mutual relations and the use of results of analyses carried out. The basic instruments for building an efficient organisation that uses LEAN management include (Walentynowicz, 2016; Matt and Rauch, 2013; Czerska, 2014; Rose et al., 2009; Kleszcz, et al., 2013):

- Deming cycle (P-D-C-A) - means successive activities in a logical order implementing the basic principle of continuous improvement of the company's functioning.
- Value Stream Mapping (VSM) - the purpose is to collect data on real material and information flows.

- 5S Principles - a method of systematic learning, discipline, standardisation and striving for excellence in the organisation and implementation of processes.
- TPM - *Total Productive Maintenance* (Global Maintenance Management). Activities aimed at ensuring the maximum availability of critical production equipment. At the same time, it is a system that allows minimising breakdowns and improving quality through the involvement of all employees.
- SMED - *Single Minutes Exchange of Die*, referring to "reduction of machine retooling time". SMED is particularly important in organising serial production and providing flexibility of the system.
- Kanban system - a system of organising the flow of information and materials between individual material processing stations, which is based on control based on events occurring directly in the course of production (and not on the basis of a plan).
- Kaizen Philosophy - This method constantly analyses individual recurring activities providing service for a selected area of the company's activity, searching for new solutions implemented in small basic stages.
- Just in Time - the assumptions based on supplying production factors in the set time and quantity in order to eliminate downtime and inventory, which effectively shortens the time of implementation of operation.

3. Process analysis and planning corrective actions

An important element of starting work on searching for new organisational solutions is proper approach and commitment of the top management in the improvement of implemented processes. It is a basic element that motivates and engages employees to act in order to achieve clearly defined effects for the entire organisation. An important element is the proper definition of partial objectives, which only in the long-term create the superior objective of company's development. These goals should be determined reliably and in relation to subsequent time stages, being a point of reference for analysing the progress in implementation of adopted plan (Mielczarek and Knop, 2016; Ulewicz and Kucęba, R. 2016; Bonovia and Marin, 2006; Bortolotti et al., 2015).

After initial training of employees in the scope of undertaken activities, in combination with practical training, one should make a map of the current state, which is the basis for planning organisational changes. Based on the employees' suggestions, a map of processes was created, which was then subjected to quantitative analysis in terms of implementation times of stages and efficiency of resource utilisation, providing a workplace with production tasks, as well as flow of the value stream in the organisation of the production hall (Kleszcz, 2018; Hines et al., 2004). Special attention was paid to the problem of internal transport, which in the employees' opinion is not effective, as well as issues related to preparation of serial production and changes in the equipment at individual positions. In order to implement the prin-

ciples of lean material management, the identification of the current state through the so-called mapping was carried out. This aimed to analyse the flow of material according to the "door to door" principle. The analysis of a specific value stream covers all activities of taking product through the process from basic raw materials to final customers (Haefner et al., 2014; Klimecka-Tatar, 2017; Rother and Shook, 2009; Żywiołek, 2016; Piasecka-Głuszak, 2014; Nowicka-Skowron and Ulewicz, 2016).

Preventing losses associated with the necessary retooling of devices has become the basis for the use of SMED principles in a company. This method applies directly to the elimination of "bottlenecks" arising at the assembly position of the fastening lock. The reason for the downtime at this stage of the process was the need for proper labelling of products, which was dependent directly on the recipient of the product and choosing the right way of labelling the product (Ortiz and Park, 2011).

After checking the correct functioning of the required device sensors according to the Mistake Proofing procedure, the first piece of product is checked. The basic documents necessary to start the manufacturing process are job instructions, component lists and MTM analyses. This documentation is available at the workplace during the production of a given product, on the basis of which an operator prepares and performs technological operations. The control process is conducted in accordance with the procedure of checking the quality of the first and last piece of product. The aim of the procedure is to introduce such rules of conduct during the control of the first and last piece of product, which will ensure compliance of products with their requirements and their repeatability during the production process. The procedure applies to all final products (finished products, semi-finished products).

Due to the variety of production resulting from the orders of different recipients, there is a need to re-set the machine coding the head of the lock. This process causes losses in the form of a break in production (machine downtime), which also translates into downtime in the entire production line and failure to use the full production potential of operators.

The observation of a working day on the analysed position revealed potential irregularities in the production process, which became the basis for searching for solutions aimed at minimising the time of retooling the machine coding the head of the lock. The results of the observations became the basis of the analysis carried out in the working team, which determined that for technological reasons, it is the most time-consuming to retool the coding station of the lock can and this operation became the basis of a detailed analysis to minimise the total retooling time of the entire line.

The first element of the improvement actions was filming the process of replacing the lock head coding instrumentation (operation no. 8). This film allowed to calculate the times of particular stages of the retooling process. The next steps necessary to perform the exchange of the coding device and estimated durations are presented in Table 1.

Table 1. Stages and times of the retooling process

Step number	Description of activities	Step time
1	Taking off the cover	14s
2	Unscrewing the screws fixing the cube with the code and removing the cube from the socket	19s
3	Disassembly of the cube	1,34 min
4	Change of code	46s
5	Assembly of the cube	2,48min
6	Putting the cube in the socket	26s
7	Putting the cover back on	39s
8	Activation of heating	2s
9	Code warm up time	10-11min

The total retooling time of the coding machine was 17.48 min. This retooling time creates a bottleneck in the production line. On average, the device is retooled four times a day, which results in significant costs related to non-production time.

4. Summary and conclusion

The second stage of improving the retooling was the determination of external and internal retooling. The planning team defined the guidelines for preparation for the retooling process and created a check list and control of the items needed for retooling.

Numerous observations conducted of the retooling process allowed to identify problems that are generated because of the time spent on retooling the machine coding the head of the lock. The possibilities for reducing the retooling time begun to be sought. In order to complete the information among machine operators, an anonymous survey was carried out. The most important element of the survey were questions and suggestions regarding improvements in the retooling process. The survey helped to identify the most important problems occurring during the retooling and the possibility of solving them.

The presented assumptions of the conducted analyses are the basis for the prepared corrective actions for the retooling process at the lock's assembly stage. A detailed plan for the implementation of specific activities and the results of shortening the time will be presented in the second part of the article.

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LEAN公司组织中的生产问题 – 第一阶段

關鍵詞

精益概念
精益生产
垃圾
效率
流程组织

摘要

今天的市场条件，尤其是非常动态变化的客户需求，大大缩短了产品生命周期。这种情况导致产品的分类和个性化的不断扩展，符合客户的要求。LEAN概念的实施是灵活应对市场变化的结果。无论是在管理还是生产方面，这一概念都旨在提高组织的效率，从而快速、动态地响应环境变化。LEAN概念（管理和生产）在管理者中的普及源于其普遍性和用于最大限度地利用现有潜力的各种工具。精益概念的主要假设旨在最大限度地利用组织的资源，确定执行订单所需的活动，并指出产生损失和最小化的区域。精益概念基于流程识别和现代化的主要工具，使用它们的难度源于需要辨别和选择能够满足组织期望的最有效的工具。本文介绍了与公司结构中实施LEAN概念的第一阶段相关的问题，即确定机会和选择合适的工具