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### LEAN MANUFACTURING TOOLS IMPLEMENTATION AND ITS IMPACT ON THE COMPANY'S OPERATION IMPROVEMENT

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#### ABSTRACT

The aim of this article is to assess the impact of Lean Manufacturing tools on the work organization of two selected manufacturing company's departments. In order to determine the effectiveness of lean concept, organizational measures were presented. They were to improve production process efficiency of the analyzed departments. The following were analyzed: standardization of the selected worksites and time reduction of tasks performance in a production process during a changeover. The study confirmed a research hypothesis that implementation of Lean Manufacturing tools guarantees time and resources savings, improves company's operation, eliminates waste.

### Introduction

The article discusses an important issue of implementation and operation of management systems in organizations on the example of Lean Manufacturing tools.

Based on the literature review (domestic and foreign), it was stated that nowadays there is an increasing universalization of concepts, ideas, models and management methods, and their movement between organizations. There is a possibility to choose a selected concept to achieve intended objectives. Those who are in charge of an organization, use tools developed by science, then modify them in such a way that they are the most effective for solving problems of a strategic or operational nature. In Poland introduction of the above mentioned solutions to improve an enterprise management process is not very popular. It means this is still an up-to-date field of activity.

The scientific goal of the paper is to analyze Lean Manufacturing - the concept of production that economically manages available resources. Using lean tools, an enterprise tends to lean production, eliminates redundant processes or insignificant for basic activities of the company's operations, creates a simplified and exhibiting greater efficiency organizational system. By implementation of lean concepts and instruments the following phenomena are noticeable: an increase of employees' motivation, development of a company's organizational culture, reduction of costs associated with production of finished products, reduction of stock levels and products' quality improvement.

This article analyzes the impact of the selected Lean Manufacturing tools for work organization of the studied production company (the owner did not give his consent to provide the company's name and the city). It was stated that satisfactory results will be achieved if few tools of lean manufacturing like: 5S, Kaizen, or SMED are to be implemented.

### **Lean Manufacturing concept - history and description**

Lean Manufacturing is a “lean” management of an organization. Although the concept's name is derived from the United States, the idea was inspired by one of the Japanese companies that in the 50's of the 20th century was eliminating all signs of waste by improving the production management system (Wojciechowski, 2011).

The main aim of the concept was to increase efficiency of the lean production process through continuous elimination of waste (Hadaś and Cyplik, 2011; Mehta et al., 2012).

Waste (Japanese *muda*) is every activity that consumes resources and does not add value to a customer. Elimination of activities that are waste is the largest potential source of achievements for an enterprise (Marchwinski et al., 2008).

Seven types of waste can be distinguished: overproduction – excessive production of finished products, unnecessary movement - unnecessary movement of operators, which arises from insufficient control and mistakes concerning organization, awaiting – for equipment repair, material, quality control, previous operation, etc., unnecessary transport – logistics errors that cause unnecessary movement of goods, materials and components or lengthen transport routes, stock – maintaining stock of finished goods in a company warehouses or at the production floor, defects – defects of design, product, technology, or information systems, training, excessive tooling – excessive consumption of materials, which is usually caused by a bad correlation of assortment of purchased intermediates and technology processing needs (Wojciechowski, 2011; 5. Kuboń and Kurzawski, 2012).

Elimination of waste is often associated with introduction of modern production technologies and innovative product concepts, but usually it turns out that these concepts and technologies are proving to be extremely simple and ready to be implemented with an immediate effect (Womack and Jones, 2003; Malaga-Toboła et al., 2012).

Elimination of *muda* is associated with the achievement of high productivity, high quality of services and manufacturing, as well as an improvement of management organization. Organizations should be directed to accept a change and guide it and should be sensitive to and ready for changes (Harris, 2009).

The lean concept allows companies to act in an intelligent way, capably tailoring its activities to environment and surrounding where they occur. New ideas, information, or innovations implemented by organizations aim to improve organizational process and lead development of companies (Wójcik, 2009).

The most popular tools of Lean Manufacturing are: 5S, TPM, Kanban, Work Standardization, SMED (Golińska, 2012). The five pillars of the 5S method are the foundation to start the improvement of an organizational structure of a company (Feld, 2001). According to Takashi Osada, a company that is not able to introduce the 5S principles will not know how to perform other tasks that are required from another competitor (Osada, 1991).

In order to analyze organization of the studied production company two selected Lean Manufacturing tools were used:

- Standardization of work is designed to identify employees who strive for self-improvement. Therefore, owing to that detailed measurements of process, improvements can be made (Liker and Convis, 2012).
- SMED, the task of which is to reduce machine changeover time. The tool's name is an acronym for the English expression *Single Minute Exchange of Die*, meaning the exchange of mould within one-digit number of minutes. The use of this method leads to the planned necessary activities performed during changeover (Golińska, 2012).

### **Standardization of the selected worksites – research results**

Development of the working standard is related to observation of operators' activities, examination of their repeatability, and then presentation of the results in a readable form.

The aim of the study was a detailed analysis of the production process of department 1 in a manufacturing company and on the basis of the obtained results beneficial changes were suggested.

The frequency of tasks performance by an operator also was recorded. Figure 1 observation sheet of an operator involved in preparation of raw materials in department 1.

In activities such as: to complement documents, no operator and awaiting time no task repetition is recorded. Tests carried out by an operator were being measured by a stopper during the study in order to calculate then average performance of each of them. Time measured at the time of operator's absence at the work position was marked with a purple color at a worksheet and with a red color the timeout of the operator working at the shift. The worksheet was created for each workposition in department 1.

Each worksite in department 1 was studied three times for the measurements to be most reliable. Every time worksite observation lasted eight hours that is duration of an operator's work in the studied company.

Based on the worksheet data, a list of activities, their frequency and time of their execution was created for each work position at department 1. The measurements were necessary to fill in the standardization work sheet.

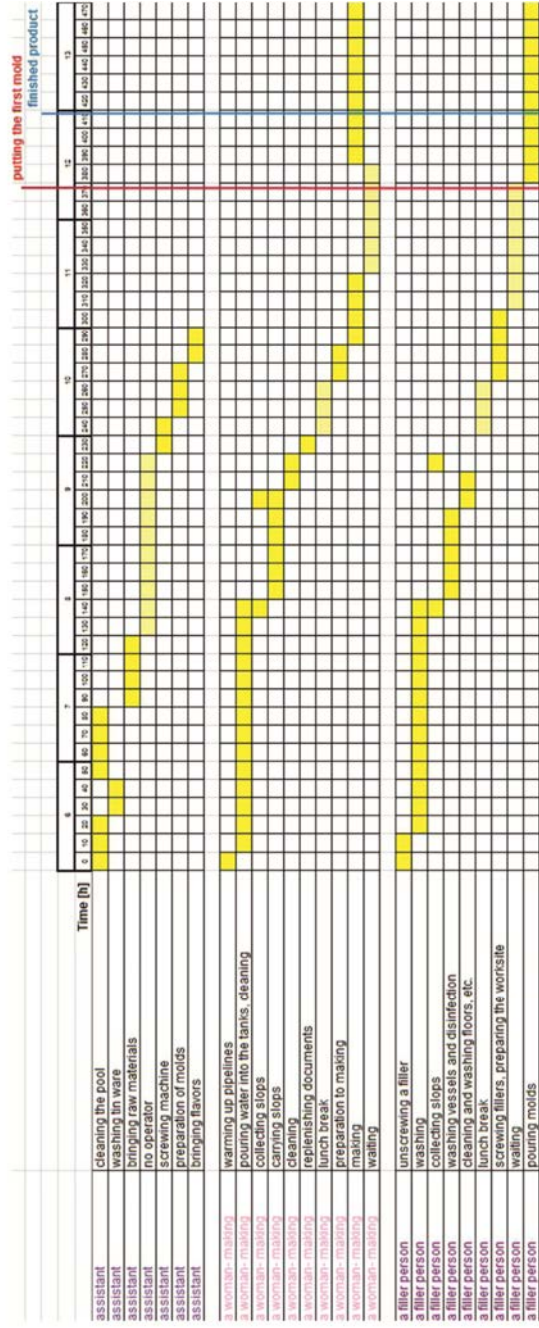
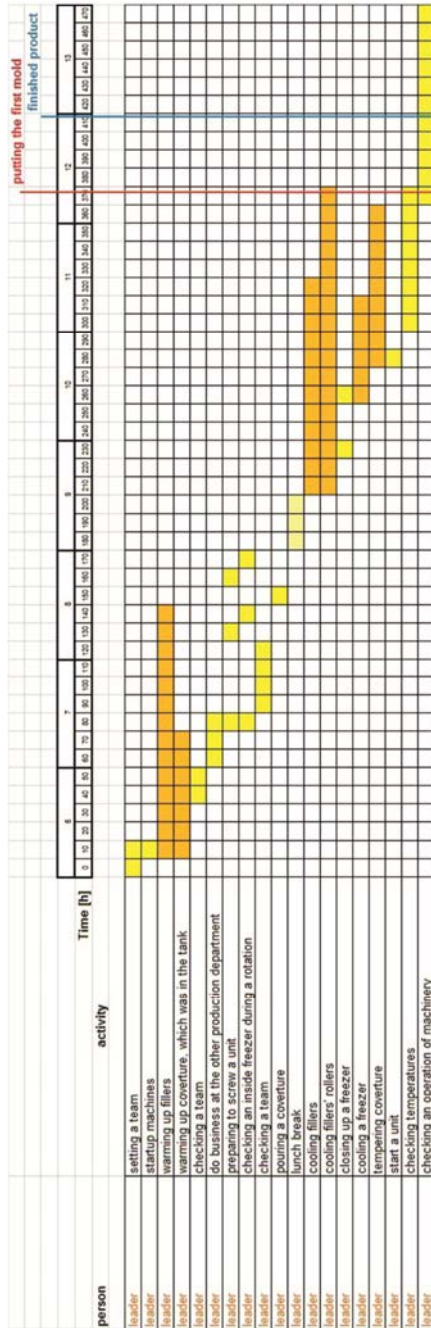
The operators' standardization work sheet in department 1 allowed drawing attention to an unequal work burden of employees, which results from different levels of difficulty and a duration of each activity performed on workstations.

The overriding objective of this study was to propose changes that would help to increase the workload of operators from values below 50% to higher values to reduce disparities of operators in the department 1.

One of the changes included an additional activity for a production worker in charge of collecting and preparing materials. The additional task was to unpack defectively packed products. During production, defectively packed products can be reused in the production process. The products recovered from defective packaging waste are regarded as useful.



Lean manufacturing tools...





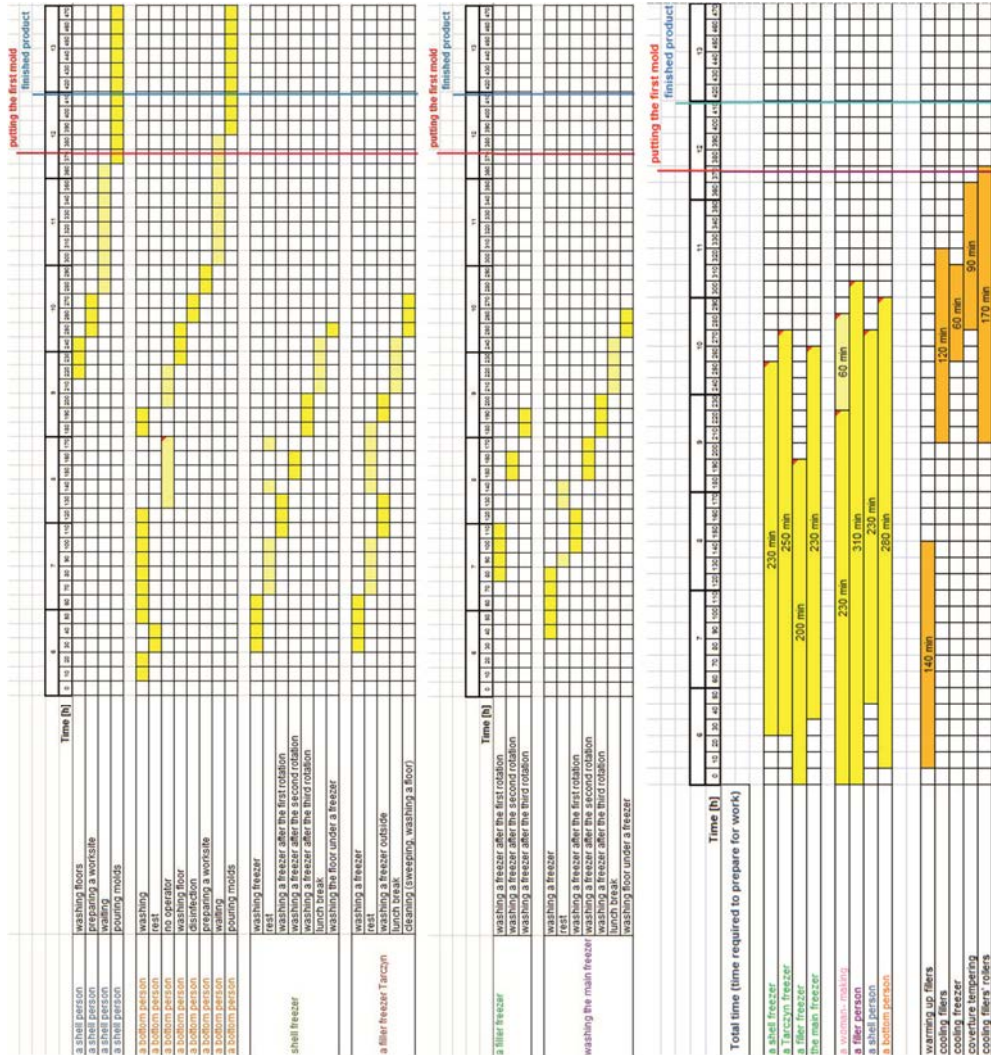


Figure 2. Presentation of the activities carried out by operators during the changeover

A study carried out in a department 1 allowed the increase of the efficiency of employees also in other work positions, among others, in case of an operator who is in charge of boiling the mass of a product 1 and in case of a worker involved in the formation of this mass. The workload of positions increased respectively: by 25% in case of an employee responsible for the production and preparation of raw materials collection, 14% for the boiling mass operator of product 1 and 15% in case of an employee engaged in the formation of this mass.

Furthermore, application of changes allowed reduction of a number of employees in the department 1 by one person. All tasks of a production employee responsible for pouring the cooked mass on the refrigerant table has been allocated to other operators, which made it possible to increase the workload of their work positions.

### **Reduction of the duration of tasks' performance in the selected processes – research results**

Any process that involves an exchange of tools or equipment, switching a device or an employee team, not adding value is called a changeover. The SMED analysis aims to reduce the changeover time to less than 10 minutes. By reducing the changeover time, it is possible to increase production by employing the same operators of the production department, the same machines at the same time. Reduction of the time in which tasks are performed during a changeover increases the duration necessary to produce finished goods, thereby making possible reduction of the production batch size and amount of stocks, which is associated with reduction in the production costs.

In department 2 a problem with washing a unit for manufacture of product 2 was reported. The unit must be thoroughly cleaned once a week, and after each eight-hour break in service operators need to wash tanks for making fillings and fillings filler. This is a problem for the investigated company because it is very time consuming. Therefore, an investigation of the cleaning process unit by employees of department 2 was conducted. This analysis could fall into the SMED method, despite the fact that the name suggests one digit value of changeover duration.

The first step of the analysis was to investigate all activities performed by employees during the changeover. The measurements were carried out on several occasions so that the tests are to be the most reliable. Figure 2 shows example measurements carried out - activities carried out at each work position in the studied company, duration of individual tasks and awaiting time of individual operators, an insertion point of the first mold to the unit as well as the output of the first finished product. Time of transition of mold throughout the unit is about 45 minutes. The figure also shows a sheet of the total time needed for the preparation of a worksite.

Changes in the work organization of department 2's operators were proposed. The main objective was to start a unit in less than 300 minutes. The prepared plan of work organization change during the changeover has been accepted and quickly implemented by operators of department 2.

### **Conclusion**

Introduction of standardization of department 1 transformed work into a process, which can be easily measured and improved. Standardization of work has given the company benefits such as: predictability of work owing to which it is known how much time is necessary to produce a finished product, stabilization and improvement of production process, increase of an operation frequency, increase of the process efficiency.

Owing to the work standardization sheet, changes to individual workstations could be made. Implementation of a new plan reduced workload's disparities of a department's staff. This change allowed elimination of waste in the form of non-productive time of oper-

ators. Moreover, it reduced the number of employees at the department 1 by one person, which improved the efficiency of the process.

The SMED analysis, performed at department 2, helped to shorten activities (performed by employees) during a changeover. Accurate observations and discussion on them had a positive effect on the change in the work organization in the company. Initial studies have shown a long awaiting time of operators. In addition, it was reported that the team had not exactly targeted the plan of action. Introduction of a new organization plan during the changeover allowed starting production with a significant advance.

Owing to the SMED analysis the studied company: increases uptime in terms of downtime associated with the changeover, reduces start-up time, reduces costs of changeover, eliminates performance of unnecessary activities.

Application of Lean Manufacturing tools helped eliminate waste reported during research. Waiting of operators at the worksites was primarily considered as waste.

During research the following methods were used to eliminate muda: observation of workers, which improves the quality of their operations and reduces non-productive work time, draw special attention to the causes of delays and losses, provide employees with valuable tips that help streamline the production process, a change of the company's culture from such where employees are interested in tasks to be done and they do them in an average way, into a company that focuses on a customer and enhances the value stream.

The so-called lean thinking is a perfect antidote to muda. Its task is to define the concept of value, ranking actions resulting in the formation of values in the most efficient way, carry out these activities without complications at times when they are necessary, as well as their more efficient implementation. In short, this is a "lean" approach because it shows how to produce more while consuming less and with less human labor, time, equipment and space, while retaining higher and higher degree of customer satisfaction (Productivity Press Development Team, 2003).

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## **WPLYW WYKORZYSTANIA NARZĘDZI LEAN MANUFACTURING NA POPRAWĘ FUNKCJONOWANIA PRZEDSIĘBIORSTWA**

**Streszczenie.** Celem artykułu jest ocena wpływu narzędzi Lean Manufacturing na organizację pracy dwóch wybranych działów przedsiębiorstwa produkcyjnego. W celu określenia skuteczności koncepcji lean przedstawiono działania organizacyjne poprawiające wydajność procesu produkcji analizowanych działów. Do analizy wykorzystano standaryzację wybranych stanowisk pracy oraz skrócenie czasu wykonywania zadań w procesie produkcyjnym w czasie trwania przebrożenia. Przeprowadzone badania pozwoliły potwierdzić hipotezę badawczą, że wykorzystanie narzędzi koncepcji Lean Manufacturing gwarantuje oszczędność czasu, zasobów, poprawia funkcjonowanie przedsiębiorstwa, eliminuje marnotrawstwo.

**Słowa kluczowe:** Lean Manufacturing, muda, SMED, standaryzacja pracy, organizacja pracy