LEAN TOOLS INFLUENCE ON THE LOGISTIC PROCESS IN PRODUCTION COMPANY

NOWICKA-SKOWRON Maria[1], ULEWICZ Robert[2]

[1] *Czestochowa University of Technology, Faculty of Management, Institute of Logistics and International Management, Czestochowa, Poland, EU*
[2] *Czestochowa University of Technology, Faculty of Management, Institute of Production Engineering, Czestochowa, Poland, EU*

Abstract

The paper presents identification of problems during the implementation of lean concept in enterprises in Poland. On the case, the manufacturer of semi-trailers car there was assessed the influence of lean tools for logistics processes in the production area. Based on studies compilation of problems in the implementation and operation of selected lean tools were presented. Additionally statement of effectiveness of selected tools in the analyzed company was developed.

Keywords: Lean manufacturing, logistic, tools, Muda

1. INTRODUCTION

The concept of Lean is a systematic approach to identifying and eliminating waste through continuous improvement of processes in production and logistics processes related to the delivery of the product according to customer requirements. Lean tools can be used in improving the logistics operations in the production process and assembly as well as in the processes of inventory management. As in Lean manufacturing philosophy and so in logistics processes you should focus on eliminating waste, in this are helpful soft and hard Lean tools. The result of this approach was the appearance in the literature of the concept of Lean logistic, which in the current reasoning can be called logistics without waste [1÷3,7,8].

Lean manufacturing from Lean logistic differs only in area of application of tools. In both cases we are dealing with the concept of MUDA (waste) and the instruments used for its elimination and processes improvement e.g. 5S, OEE, 8 step Practical Problem Solving (PPS) Method, Pareto Analysis, Kaizen , Setup Time Reduction, Process Mapping, Value Stream Mapping (VSM), Quick & Easy Kaizen, SPC / Control Charting, 5 Whys, 5W2H, Continuous Improvement, Continuous Flow, Visual Controls, Design for Six Sigma (DFSS), Cellular Manufacturing, Production Levelling, KANBAN / Line Balancing, VOC (Voice Of The Customer), Jidoka, ANOVA, Work Standardization, Work Simplification, Fishbone diagrams Six Sigma, Takt Time, QFD and Poke Yoke / mistake proofing. Typical, published results from the implementation of Lean concepts logistic in enterprises are suspending the efficiency of shipping by 30%, reduced inventory by 15% and further reduction of made qualitative errors by 30% and increase of the level of security also about 30% [4÷6,9,12].

The question arises whether you should use all mentioned tools? What will be their effectiveness and whether the culture of the organization as well as the workers themselves are prepared to work with the tools of Lean? In the Lean organization must be precisely defined rules of cooperation independently whether it will be a production worker or operator of means of transportation. In Lean logistic all participants need to know that they are the source of knowledge about how to eliminate waste and from their involvement will depend to what extent they will contribute to its elimination. The efficiency of logistics processes in the production system depends on the use of methods and techniques which improve materials flows namely will eliminate waste. The article is an attempt to assess what is the impact and what is the effectiveness of the Lean tools to improve logistics processes.

2. IDENTIFICATION OF WASTE IN LOGISTICS PROCESSES

The aim of Lean tools in production is to fight against waste in case of logistics processes (supply chain) waste takes on new meaning. When analyzing the impact of Lean tools on logistic processes there were carried out identification of the waste in the aspect of implementation of logistics processes [4,10,11].

- In the case of Muda - overproduction in relation to the logistic processes in the majority of identified cases we are dealing with the improper priority of tasks and improper scheduling of means of transportation.
- In case of expectations we should divide the problem into two areas. The first concerns the external expectations associated with delays related to handling inbound deliveries, slow inventory replenishment is so called unbalanced work. In case of the internal expectations the problem concerns expectation (in the analyzed company) on the corresponding assembly components in assumed time window on given assembly station. There happens also problem of providing improper component in given time window for a given assembly station. What in consequence causes waste of transport and generates unnecessary costs.
- Waste of movement is pure logistics process associated with improper storage, poorly laid out releases and admissions zone. We also cannot forget about the wastefulness of traffic associated with the search for relevant components of production, transport containers or finally production tools.
- Waste of inventories is a maladjustment of the size and time of delivery in relation to the real needs in a given time interval. Consequently, this can lead to a slow-moving inventories (here also occurs a waste of capital - the frozen financial resources). Possession of surplus stocks allows to mask problems in the company, among others, product quality, unreliable suppliers and poor technical condition of the machines.
- Waste of space associated with lack of storage space optimization but also with the inadequacy of the size of the production containers to the dimensions of transported parts. Another manifestation of the space waste is non-optimized storage of tools for the tool magazine but most of all sub-optimal storage of tools in the area of workstations.
- Waste of defects - these are not only defective products but all the processes which because of resulting errors must be repeated. From the viewpoint of logistics these can be e.g. errors in transport documents, wrongly classified and labelled materials and manufacturing containers or damage to the logistics carriers.

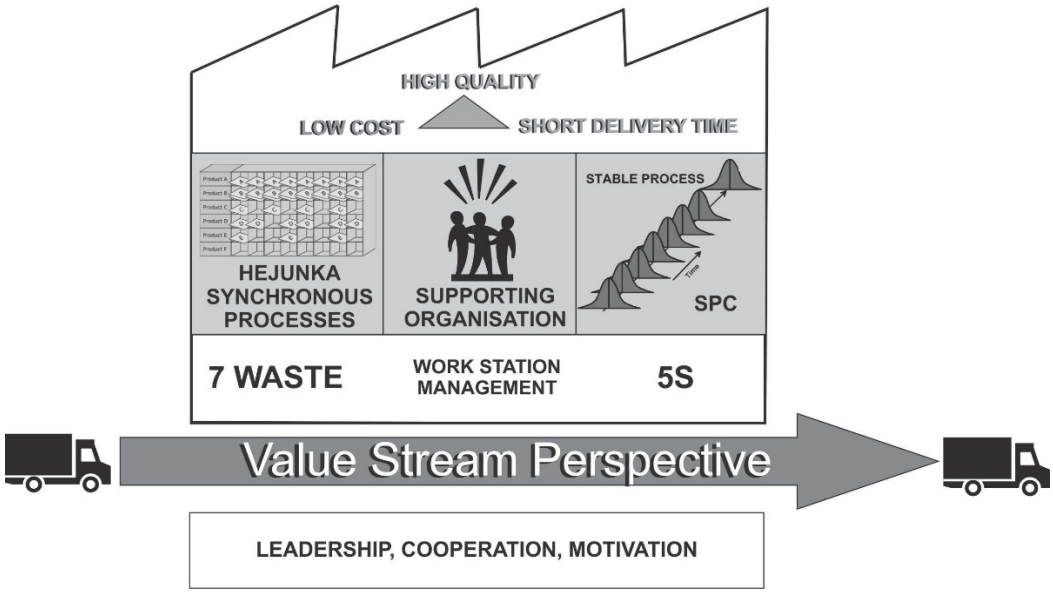

Figure 1 Assumptions of using Lean tools in logistics processes

Figure 1 shows the general principles of the use of Lean tools in logistics processes.

3. RESEARCH METHOD

Research concerning the effectiveness of application of Lean tools and their impact on the logistics processes were carried out in the company belonging to the leading manufacturers of car trailers and semi-trailers as well as truck bodies for trucks. The number of staff employed in the audited company exceeded 1000. The study was limited, however, to the management and employees of one production hall. The study was conducted in two groups, to the first group was qualified management team including the leaders of processes in particular auxiliary areas and areas of direct production. To the second group was qualified operating personnel. The study was conducted in the form of survey supported by direct interview as well as own observation of realized processes in evaluated production cycle carried out after receiving the results of a survey in order to verify them. Subsequently from the obtained research there were separated responses of the staff responsible for the execution of logistics processes and compared with the remaining group of employees. For research was qualified 115 correctly completed questionnaires and filled in sheets from direct interview. Respondents had to answer questions concerning ten selected Lean tools. The questions concerned the level of knowledge of methodology of instruments use, the effectiveness of the action (impact and effectiveness assessment on the improvement of realized processes), and the type and duration of completed trainings in the field of Lean if such took place. Test results are provided in the form of weighted averages for each tool. Each of the respondents had to answer to what extent he agrees with the statement e.g. use of 5S (OEE, SMED, etc.) influences the improvement of logistics processes.

4. RESULTS AND DISCUSSION

Questionnaire survey was conducted in the first quarter of 2016, the study included responses of 115 respondents who responded on 10 selected instruments of Lean (**Table 3**). For each instrument, the respondent had to choose a scale from 1 to 5. The results for the question whether you agree with the assertion that the elimination of Muda influences the improvement of logistics processes are shown in **Table 1**.

Table 1 Respondents' answers on the impact of the elimination of MUDA on the logistics processes

Answers	Number of respondents	Percentage share
1 - Strongly Disagree	2	1.75
2 - Disagree	3	2.61
3 -Normal	6	5.22
4 -Agree	29	25.22
5 -Strongly Agree	75	65.22
TOTAL	115	100

Conducted research indicated that according to the respondents the most important influence on implemented logistical processes has the elimination of waste. On very strong influence (5) on elimination of MUDA on the logistics processes indicated 75 respondents representing 65% of the respondents to the strong influence (4) 25% of respondents that totally is 90% of respondents. Analyzing the results with division on the management staff and leaders of processes and production workers 100% of management staff responded that the elimination of MUDA has very strong impact on the improvement of logistics processes. All employees in both research groups underwent adequate training on issues of MUDA elimination. According to the employees it is precisely the elimination of waste has the greatest impact on improving logistics processes, as instruments with the least impact on the improvement of logistics processes employees pointed 8 step problem solving Method, OEE and balancing of production (Hejunka). **Table 2** summarizes responses about the impact of 8

step problem solving Method, which in the opinion of the respondents has the least impact on the improvement of logistics processes.

Table 2 Respondents' answers on the impact of 8 step problem solving Method on the logistics processes

Answers	Number of respondents	Percentage share
1 - Strongly Disagree	35	30.43
2 - Disagree	37	32.17
3 -Normal	14	12.17
4 -Agree	14	12.17
5 -Strongly Agree	15	13.04
TOTAL	115	100

The results of respondents for 8 step problem solving Method indicate small effect of this instrument on the improvement of logistics processes, only 35% of respondents indicated a significant impact on the improvement of logistics processes and 65% of respondents indicated that there is no significant impact. In both research groups similar distribution of results was observed. The study excluded employees who did not have training from a given instrument that is why to the study was included only 115 sheets of questionnaires.

Table 3 summarizes the results obtained for all the 10 analyzed Lean instruments. In the studies was used weighted arithmetic (W_{av}) mean in order to determine the rank of a given instrument according to the formula.

$$W_{av} = \frac{W_1 \cdot X_1 + W_2 \cdot X_2 \cdots W_n \cdot X_n}{W_1 + W_2 \cdots W_n}$$

Where:

$W_1 \ldots W_n$ - weight

$X_1 \ldots X_n$ -The number of respondents responding (Strongly Disagree…… Strongly Agree)

Table 3 Ranking of the impact of selected Lean elements on the improvement of logistics processes

Ranking	Instruments	Weighted arithmetic mean
1	Elimination of Muda	34.47
2	5S	32.35
3	Process Mapping	30.02
4	VMS	29.80
5	Kaizen	28.54
6	Pareto-Lorenz	27.34
7	SMED	25.49
8	OEE	24.23
9	Heijunka	20.04
10	8 step problem solving Method	18.80

From the analysis of obtained results of weighted average (**Table 3**) for individual instruments we can conclude that, in the opinion of employees the greatest importance for the improvement of logistics processes has Elimination of waste (weighted average 34.47) in next step 5S (weighted average 32.35), process mapping

(weighted average 30.02) and value stream mapping (weighted average 29.80). Fifth place in the ranking takes Kaizen with weighted average at the level of 28.54. It should be emphasized that the first four Lean instruments we can directly link to the improvement of logistics processes, in case of Muda we eliminate waste associated with the logistics processes (Lean logistic). 5S also refers directly to this area and is the guarantor of maintaining order within the hall, stores as well as maintain order means of transport. Next, we have the instruments related to the exploitation of technical means namely OEE and methods of fast retooling. In the opinion of employees and management staff has rapid setup of machines and equipment. Respondents indicated that the least impact on production processes has balancing production (which was somewhat surprising) and use of 8 step problem solving Method. Analysis of the reasons for such a low assessment of the impact of balancing production on logistics processes had its cause in lack of understanding of the concept of Heijunka despite conducted training in this field. This indicates again on the role of relevant practical training in improving competencies of employees.

5. CONCLUSION

The article presents a small part of research related to the analysis of the impact of Lean instruments on implementation and improvement of logistics processes of various industries. For analyzed research object was taken into account only 10 tools associated with carried out training and knowledge of these tools by employees. Carried out research has clearly indicated the positive effect of Lean tools on improvement of logistic processes in the area of improving the flow of the supply chain both internal and external. This is confirmed by the high assessment of the impact of the elimination of MUDA and 5S, as well as instruments used for processes mapping and the flow of added value. The use of one of the first five evaluated instruments will have in a short period of time a large impact on improving the productivity of logistics processes.

ACKNOWLEDGEMENTS

The authors are grateful to Eng. Pawel Szataniak PhD. for comments on the technical aspects of semitrailers production and logistic process.

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