LEAN MANAGEMENT TOOLS SUPPORTING THE TWI PROGRAM

Marzena KUCZYŃSKA - CHALADA, Joanna FURMAN

Silesian University of Technology, Faculty of Materials Engineering and Metallurgy, Katowice, Poland, EU
joanna.furman@polsl.pl; *marzena.kuczynska-chalada@polsl.pl*

Abstract

The TWI (Training Within Industry) program is considered the foundation of Lean Management. It is a program to develop the skills of superiors in the field of instructing employees and improving working methods which translates into an improvement in the organization of logistics processes. The improvement of working methods aims at increasing the production capacity with the same human resources, materials and machines, while at the same time producing more good products in terms of quality in a shorter period of time. The aim of the article is to develop documentation in accordance with the TWI method for operators in a selected production company. Presented is the method of preparing documentation using the Kaizen workshop.

Keywords: TWI (Training Within Industry), production logistics, Lean Management, Kaizen

1. INTRODUCTION

The TWI (Training Within Industry) program is considered the foundation of Lean Management. It is a program to develop the skills of superiors in the field of instructing employees, improving working methods and relationships with employees. Instructing employees is a way to effectively train employees so that they do their job properly, consciously and safely. The improvement of working methods aims at such a situation when with the same human resources, materials and machines the production capacity would increase, while at the same time producing more good products in terms of quality in a shorter period of time. The Lean Management concept, colloquially known as "lean production", has a significant influence on the development of innovative solutions in production management. This concept allows the company to improve its operations by eliminating wastage and optimizing the flow of value in the production process [1]. Enterprises using Lean Management achieve higher productivity, work efficiency, product and service quality and are customer-oriented in every activity. Implementation of the Lean concept principles is possible due to the launching of tools to eliminate wastage, such as: standardization, suction system, kanban, Just-in-Time, Kaizen, 5S, SMED, Poka-Yoke and Jidoka. The article presents the results of the analysis carried out on the assembly line. Presented is the method of preparation for creating documentation using the Kaizen workshop, and then familiarized with the standardization process valid in a given manufacturing company. The process of training employees and checking and assessing their competences regarding the movement of operators between positions during the work shift was approximated. Due to the availability of TWI instructions on the production line, the production logistics in the surveyed enterprise was improved.

2. LEAN MANAGEMENT WSPIERAJĄCY LOGISTYKĘ PRODUKCJI

When making production-related decisions and production logistics, solutions are developed within the information and property flow in accordance with emerging conditions and needs, including, among others, demand forecasting, product planning, device deployment, process design, aggregate planning, production capacity management, economy warehouse. For this purpose, various types of tools are used to improve the flow and identification of details in the supply chain, which are based, among others, on the concept of Lean Managenent [2].

The production logistics includes all processes related to the equipment of the production process in the relevant goods (auxiliary materials, raw materials, semi-finished products, expense storage, and preferably

directly to the customer (directly), taking into account their satisfaction [3,4]. New conditions (globalization, virtualisation, branches of chain, innovativeness, etc.) made the problem of trust really popular. Trust is the feature of business relations [5].

Improving the process it should be remembered that an important element is also the aspect of work safety - the implemented solutions should include safe working conditions and reduce the number of potential accidents [6]. Well organized production logistics should provide [2]:

- providing all materials, components and parts of the product at the time of commencement
- implementation of a given order,
- rhythmicity and continuity of running production,
- favourable conditions for using modern internal transport,
- adequate stocks of finished products in the supply area,
- the possibility of shortening and improving production cycles,
- selection of packaging (collective and unit) of logistic units, in order to increase it
- transport and storage efficiency,
- possibility of using automatic identification.

The philosophy of Lean Production is based on five principles [7]:

1) determining the value for a specific product,
2) identifying the value stream for each product,
3) ensuring the flow of value stream,
4) implementation of the suction system,
5) striving for excellence.

The principle of determining the value refers to the assumption that the value is created by the producer, but it can be defined only by the end user. For this reason, manufacturers should change their thinking about the value of the product by adopting the customer's point of view. For the customer, the value of the product is a set of benefits that they acquires with the product, e.g.:

- technical level of the product,
- total product costs,
- convenience of placing an order,
- Manufacturer’s help in the installation of the product and its operation,
- additional benefits affecting customer attachment and loyalty.

The Lean concept therefore requires understanding the client's needs and defining what constitutes value in the product for them [8]. Correct identification and definition of customer‘s needs should occur already in the product design phase, and the customer's opinion should be taken into account during the entire manufacturing process, up to the launch of the product.

The next step in defining the value is to determine the cost of the product, based on the price of the resources used and the workload, reduced by eliminating waste. The cost thus determined is much lower than the production costs of competing companies.

The next principle of "lean production" is to identify the value stream. The Value Stream includes all activities (both adding and non-enhancing values) leading to the creation of a particular product. These activities can be divided into three categories:

- activities creating value for a customer,
- activities not adding value, but temporarily necessary,
- activities not adding value possible to immediate elimination.

Identifying the value stream for each product leads to the detection of wastage (Japanese muda), that is, any activity that requires labour input, resource consumption, but does not create added value. There are seven kinds of basic types of waste [9]:

- overproduction - all that is created too quickly, too many in relation to the needs and when there is no customer yet. It generates problems with the flow of information, materials and inventory,
- production shortages - these are shortages and errors of employees, problems with quality, as well as delivery of defective materials,
- unnecessary supplies - these are excessive stocks and delays of information or product, everything that unnecessarily consumes financial resources and space,
- improper production methods - the use of inappropriate tools, procedures, technologies, often in a situation where simpler and more effective solutions are available,
- downtime - long periods of inactivity of people, information or materials. Downtimes may be due to failures, improper organization, lack of discipline, waiting for raw or missing parts. This results in improper flows and long production cycles,
- excessive transport - unnecessary movement of people, information or materials. As a result, wasted effort, time and rising costs,
- unnecessary movement at the workplace - improper organization of workplaces, improperly planned space, unnecessary movements that consume too much of human time and energy, e.g. walking for part, searching for tools.

3. IMPLEMENTATION OF TWIPROGRAM - CASE STUDY

The enterprise described in this publication is a company from the energy sector, which has its factories in over one hundred countries, including Poland. The company introduces comprehensive and innovative solutions in the field of energy optimization, integrated energy management systems, machine automation and control systems.

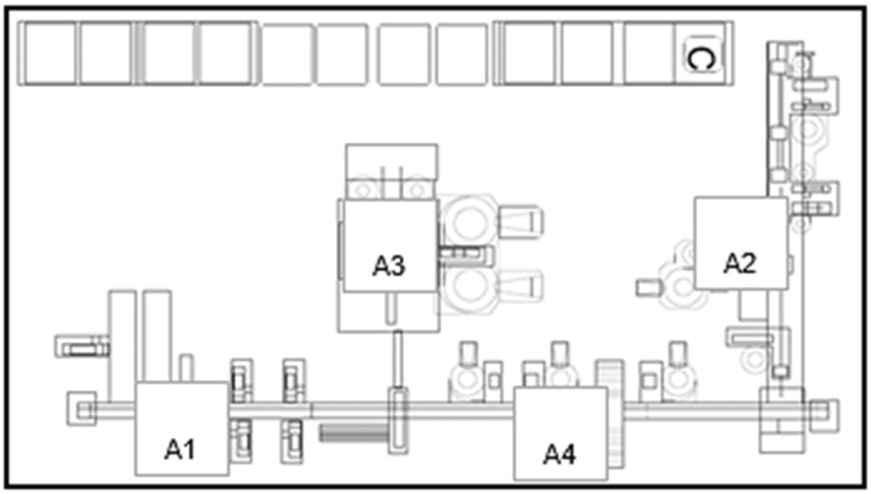

Figure 1 Location of machines on the production line

The analysis covered the fully automated line, consisting of four stations - A1, A2, A3, A4. The location of the machines on the production line is shown in **Figure 1**.

The first stage of implementation of the TWI program on the selected production line was running Kaizen workshops, in which people responsible for creating instructions and conducting trainings, operators working on a selected line and maintenance engineers assigned to a given sector took part.

The first phase of the Kaizen workshops consisted in the operators writing out all the activities performed during work, related to the correct operation of machines, repairing defects, retooling and product control.

Table 1 A list of activities that need to be implemented [Own elaboration]

No	Process description
1	Beginning and finishing work
2	Manual posts' control / initialization
3	Control of samples
4	Replacement of the crimping tip / height adjustment
5	Grease tapping/ grease dispensing station
6	Adjustment of the discus
7	Adjusting the riveting height
8	Checking the riveting strength of the body
9	Change of references
10	Printer handling

Due to the specificity of the automatic line, it was necessary to specify which activities should be performed by operators and which should be carried out by maintenance staff, because until now there was no clear division of duties, so no one wanted to take responsibility for the repair and regulation of machinery. This caused many conflicts between operators and maintenance workers. For this reason, it was necessary to make a clear and transparent division, so that operators knew which activities are responsible for and which require the call of a support service employee.

As a result of the work carried out during the Kaizen workshops, a list of activities requiring the implementation of standby and auxiliary instructions under the TWI program was detailed, which is presented in **Table 1**.

After creating instructions with TWI method, the instructions were placed on the production line. Workstations instructions presenting the activity performed in a shortcut were hung on the door of the machine. However, auxiliary and general instructions were placed in a binder located on the operators' desk, in a specially designated place. After launch of the documentation, the operators were trained to perform the following activities. During the training, the instructions for a trainer were used, which allowed conducting the TWI four-step training. The next step was to make a questionnaire checking the knowledge of the operators. In order to measure the competence of the operators, tables of competences were developed with the standard adopted in the company. It was established that:

- tables of workstations competencies and additional competences are complemented at the end of each week, remembering about the colour change in the absence of more than 6 months (applies to fitters). In the absence of leaders and trainers, the colour change takes place only after 9 months. The boards are printed by the 5th day of each month;
- restoring colours in the competency table (after the absence) the trainer decides for the fitter, and the Production Coordinator decides for the leader and the trainer. In cases of additional functions and powers, decisions may be taken by the Production Coordinator in consultation with the support departments;

- in the next days of training a new employee, the trainer is obliged to control the p/z appliances for the person who is training. At the end of the training there is a practical test, the trainer introduces faulty appliance in the amount of 10 pieces without the operator's knowledge;
- positive test ends with 80 % detection of defects, when the result is below the expected operator undergoes another training. If the required number of points is not obtained again, the information is sent to the Production Coordinator, who decides whether or not the employee is allowed to work.

4. CONCLUSION

The TWI program, which is the foundation of the Lean Management concept, enables fast and effective employee training through the development of supervisors' skills.

Lean Management is currently the most effective method of increasing productivity by eliminating waste, shortening the production cycle and manufacturing only products that the customer expects (suction system), in the right quantity and at the right time [10].

Conducting the Kaizen workshops allowed to separate the activities for which operators are responsible. Standardization of TWI cards has made it possible to standardize documents, due to which the employees‘ trainings run in a more effective manner.

TWI instructions are directed to all employees, even inexperienced, thanks to simple and clear instructions. Due to the availability of TWI instructions on the production line, operators, if in doubt how to perform an action, can find it helpful at any time.

Conducting a competence test questionnaire allowed to determine the level of knowledge of operators. The training of employees in accordance with the TWI method allowed to raise their competences in the scope of work performed.

An increase in productivity by 3 % was noted and thus production management in the aspect of production logistics improved.

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