

LEAN SIX SIGMA IMPLEMENTATION IN LOGISTICS COMPANY

Ryszard BUDZIK, Lilianna WOJTYNEK, Ewa KULIŃSKA

*Technical University of Opole, Faculty on Production Engineering and Logistics, Opole, Poland, EU,
r.budzik@po.opole.pl*

Abstract

The article characterizes Lean Management and Six Sigma, two methods for improving processes. The combination of Lean and Six Sigma brings benefits for companies applying this method. The paper presents the differences and similarities between these methods and also describes Lean Six Sigma method, which is a combination of the most important advantages of Lean Management and Six Sigma. The implementation of this method in the logistics company was described. The aim of the work was to present the possibilities of using selected Lean Six Sigma tools in logistics processes.

Keywords: Lean Management, Six Sigma, Lean Six Sigma, DMAIC, Improving processes

1. INTRODUCTION

Lean Six Sigma has rapidly established itself as the key business process improvement strategy of choice for many companies [1]. Lean Manufacturing Methodology is used to eliminate unnecessary costs during the production process. The concept developed into a Lean Management model for companies, and later into the Lean Thinking philosophy. This concept is based on the elimination of all operations and activities that are not of value to the final product or service from the customer's point of view. Six Sigma is based on confirmed customer needs. Decisions are made the basis of collected data and facts. The variability of the process is investigated and analyzed. All root causes associated with problems are eliminated.

Lean and Six Sigma are process and quality improvement methodologies that have been adopted with success in the manufacturing industry. They are now being extended into supply chain and logistics industries to cut down operating costs and improve delivery reliability through improving and controlling processes. The basis of this concept is PDCA cycle by Edward Deming. The PDCA concept was developed by Walter Shewhart, a pioneer of statistics. From his name it is called the Shewhart Cycle. Edward Deming also promoted this concept during his training in Japan. That is why this model is referred to as the Deming Circle or the Deming Cycle. This cycle has been developed and adapted to the needs of the methodology [2-5].

A new DMAIC cycle was created, and as a result of combining the concept of Lean and Six Sigma, a new approach of Lean Six Sigma was created. The aim of Six Sigma is to reduce costs and increase benefits by eliminating process variability using statistical methods [6].

In this article, the logistic process was selected for analysis on the basis of given criteria. Problems were identified. The article presents selected Lean Six Sigma tools used to improve the process of delivery to the warehouse, selected on the basis of the adopted criteria.

2. A REVIEW OF METHODOLOGIES FOR IMPROVING PROCESSES

2.1. Lean Management, Six Sigma, Lean Six Sigma

Lean, in general, focuses on eliminating waste and decreasing cycle time, while Six Sigma is geared toward reducing variability and improving quality. More and more organizations are fully integrating these two continuous improvement methodologies. Lean Six Sigma focuses on eliminating waste in systems and on implementing statistical methods to drive breakthrough improvements to an organization's processes. Lean



Six Sigma combines the best of both approaches. Lean Six Sigma projects use Lean tools during the DMAIC Cycle to stabilize the process, while Six Sigma help to track the causes and control the process.

2.2. DMAIC

The DMAIC (Define-Measure-Analyze-Improve-Control) method in Six Sigma is often described as an approach for problem solving. The DMAIC model was used to solve the problem in the company. The model is shown in **Figure 1**.

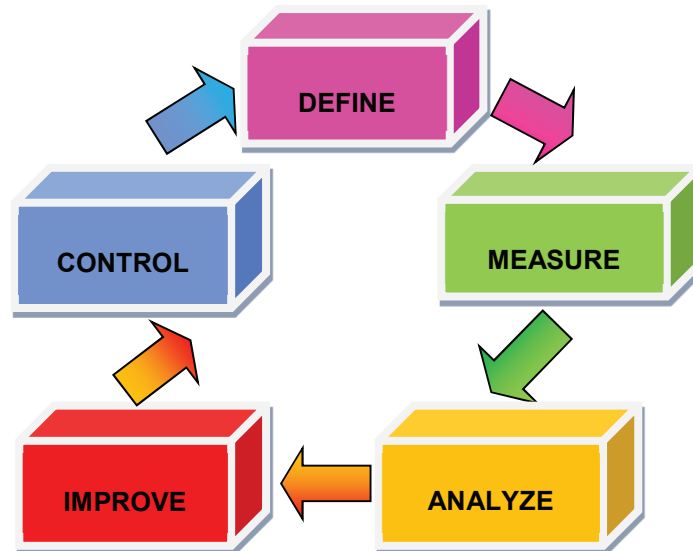


Figure 1 DMAIC model [6].

Defining is the first stage of the DMAIC method cycle. During the definition, a test is carried out, critical points for the quality of the offered products or services are defined, which are most important for the customer [6].

Critical points for the quality of the offered products or services are defined, which are most important for the customer. Critical points are detected. A “Customer Voice” survey is carried out. It detects what is most important for the customer in a product or service, asking them to fill in a survey or using other marketing tools.

The project card is important during the definition phase. It specifies and organizes the information collected. The source of the problem and possibilities of solutions are identified. A study is carried out on how the proposed solution has brought the intended effect. The third stage of the definition phase is to create a process map. This map shows the course of the process.

The most important stages of the process are taken into account, information is collected about the customer, his expectations, needs, key input elements of the process are presented, allowing for its efficient operation.

In the fourth stage of measurement, the key process parameters are measured, the data used in the analysis are collected, as detailed as possible. Measuring tools are identified. Relationships at the cause-effect level are examined, which makes it easier to determine the relationship between the elements of the process.

At this stage of the DMAIC method it is necessary to consider where the problem is, what is the cause of the problem. The aim of the introduced changes is defined - diagnosis of the current state of the process and what you want to achieve.

The aim of the changes is defined; changes are introduced that are aimed at achieving the set goal. Thanks to the analysis in the DMAIC method, a reference point is created - determination of the current state, determination of the appearance of the desired state after the introduction of changes. The improvement stage in the DMAIC method is an improvement of the process [6].



The analysis of collected data is taken into account in order to introduce the desired changes, which will allow to eliminate or minimize the problem.

At the stage of control, it is verified whether all the introduced changes have brought benefits, and the current state is better than the previous one.

2.3. The Tools of Lean Six Sigma

The following tools used in Lean Six Sigma can be specified:

- 5 Why's,
- 5 S System,
- Value Stream,
- Mapping,
- Regression Analysis,
- Pareto Chart,
- FMEA,
- Kaizen,
- Poka -Yoke.

3. METHODS AND RESULTS

The task of the warehouse in the delivery acceptance process is to verify compliance with the materials delivered with the order and the delivery of the material to an appropriate area production.

The process of delivery to the warehouse was analyzed. Conformity of materials with the order and their delivery to the appropriate production area was verified. Two working days it was time set as the timely acceptance of the delivery. One day for unloading was planned. The working time of warehouse employees was set at 06:30 to 18:30, Monday to Friday.

Figure 2 shows the consecutive phases of the delivery process to the warehouse. Method 5 W2H was used to describe the problem more precisely, as shown in **Table 1**.

Table 1 Application of method 5 W2H in the process of taking delivery to the warehouse

5W2H METHOD		
1.	WHO?	A production planning department and a production department
2.	WHAT?	Lack of availability of materials for production. The delivery from the warehouse has not been released
3.	WHEN?	Low level of material availability exists and has been maintained for 4 month, from september 2017
4.	WHERE?	Warehouse department
5.	WHY?	Lack of availability of materials for production may result in failure to meet the deadlines for completion of orders and disructps the production schedule
6.	HOW?	If there is a need to use the material for the execution of the order or to confirm the deadline
7.	HOW MANY?	Daily, about 2-3 types of materials for 2-3 different orders

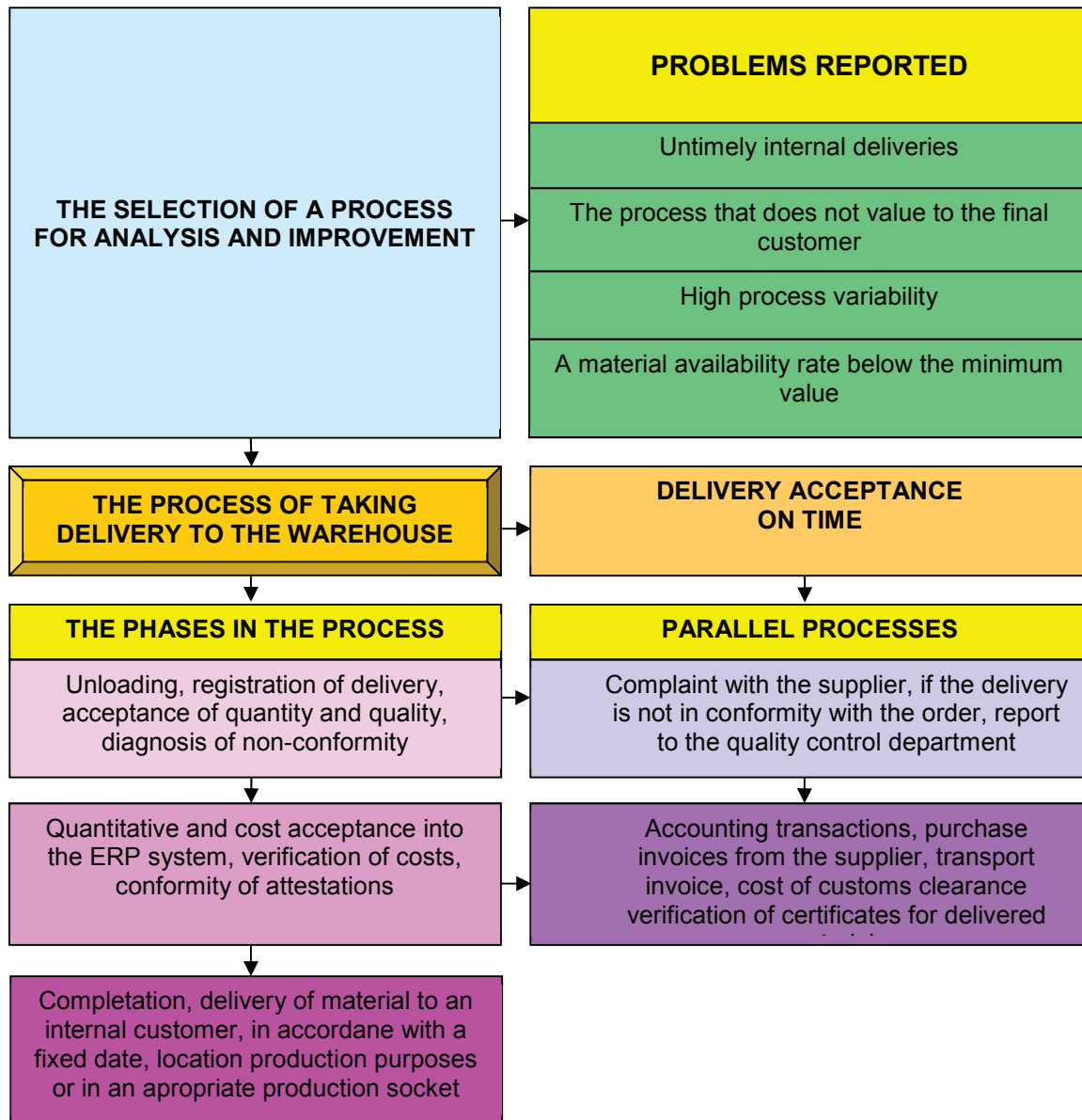


Figure 2 The process of taking delivery to the warehouse

The tools used in each of the DMAIC phases are shown in **Table 2**.

Table 2 Tools used in each of the DMAIC phases in the project

DMAIC phases		Tools
1.	DEFINE	Critical to Quality Trees (CTQ)
2.	MEASURE	Histogram of delivery arrivals
3.	ANALYZE	Pareto Diagram, 5 Why, Brainstorming, Ishikawa Diagram
4.	IMPROVE	Kanban, Standardization, 5S
5.	CONTROL	Pareto Diagram for late deliveries, PDCA

All the tools presented in **Table 2** have been applied in practice in order to improve the analysed process.



Figure 3 shows the use of one of the tools - Critical to Quality Trees (CTQ).

CTQ trees give a visual layout of what a customer expects for a product, what their needs and interests are for that product. CTQ trees are used with the Sigma Six methodology processes.

The first step in creating a CTQ tree is to find out what a customer’s functional requirements are for a product. This first step has a lot of sub-steps, all of which are directly related to what a customer is looking for. These goals are of course achieved with open dialogue between both the team working on the CTQ as well as the customer.

When the requirements are met, then it is time to set measurements for the requirements; that is, that discussion begins on how realistic the requirements are. The last step is to confirm the requirements that the customers have set for the product and that those requirements can be met by the company or manufacturer. Again, open discussion is advised in order to get to a point where both the customer and the company are happy with the projected ideas and expectations.

The main points a CTQ tree are to make sure that the needs of the customer are met and then converted into a reasonable and detailed project plan for continuation. It also helps the team working on the project get from the idea stage - that of the needs and requirements of the customer - to the planning stage.

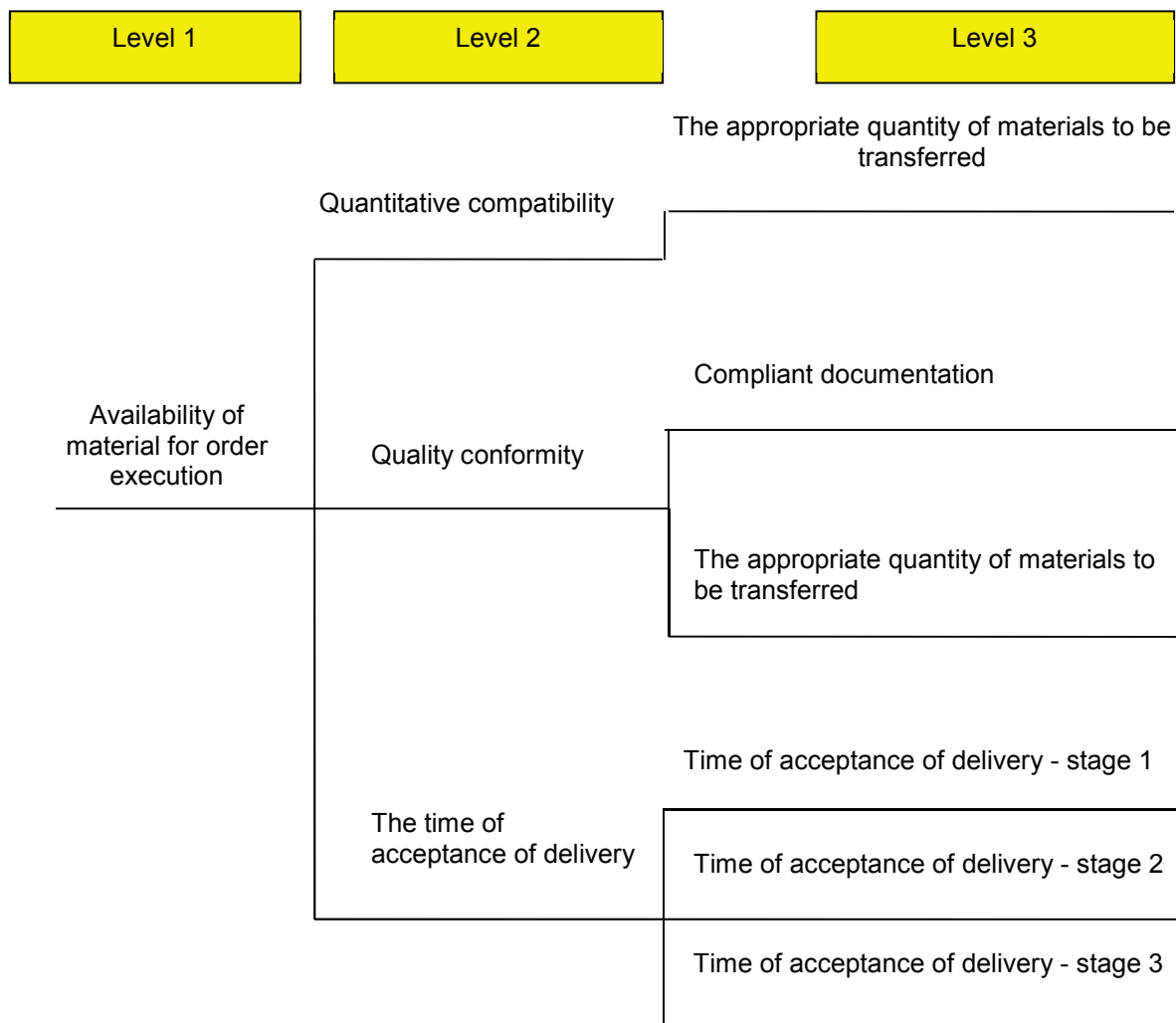


Figure 3 CTG tree for internal customer - production department

4. CONCLUSION

Different methods are used for the planning of production processes. Various logistics concepts and systems are also used [7-9]. The Lean Six Sigma tools and methods have helped to streamline the delivery process. However, this process requires continuous improvement according to the PDCA method. Lean Six Sigma tools should be used to streamline manufacturing and non-production processes. These tools are simple, with no additional costs associated with improving process quality. Excellence is achieved through the use of the DMAIC cycle. The methodology presented in the article is universal. These tools can be used where it is necessary to improve the efficiency of the process. People and their teamwork are necessary to solve problems. Accurate analysis of collected facts and data allows for making rational and effective decisions. Ensuring proper quality and effectiveness requires a properly arranged process. Incorrectly collected data and facts will result in making wrong decisions. The target has been achieved in 90 %. It should be noted, however, that the process is characterized by high potential for improvement and low stability. There are many more potential reasons for the lack of availability of material for production: employee absenteeism, increased production, other logistics projects, expansion of facilities, staff changes, lack of automation in the process, disruption in the flow of information, too few handling equipment, lack of investment in the development of the warehouse department. Lean concepts, by identifying problems and their determinants, as well as through implemented solutions and their monitoring, they provide knowledge packages. The concentration on knowledge is the basic resource in business management [10].

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