

Review of Lean Six Sigma DMAIC to improve the quality of the production process

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Abstract:

Currently more and more companies search for management methodologies that allow them to improve their products and/or service characteristics, perfect their processes, decrease costs, improve the capital's profitability and costumers' satisfaction, for this Lean Six Sigma methodology have an important tool. The present article proposes a Lean Six Sigma (LSS) project management improvement model supported by the DMAIC cycle and integrating an enlarged and adapted set of statistical tools for quality improvements in production involved processes. The aim of Lean six sigma is defining, analyzing, correcting and improving the variables, which affect the quality of production process in order to decrease the number of defects and the failures and to propose the improvement means for the processes.

Keywords: *Lean, Six Sigma, DMAIC, Lean Six Sigma(LSS)*

1. Introduction

Lean Six Sigma (LSS) has been seen as a business improvement method for integrating two different management theories: Lean and Six-sigma complementing each other in order to improve industry processes and production. This integration has been achieved by mixing their methods and principles using the DMAIC cycle as the continuous improvement framework as well as making efforts to reduce production defects and process variability along with process simplification and standardization and waste reduction.

There are many different conceptions, methods and tools that may be used to maintain the good quality level and help in continuous development in the. For example, it can be Six Sigma which is an innovative method of quality management introduced in Motorola by Bob Galvin and Bill Smith in the middle of the eighties. "Sigma" is a notion taken from statistics. It means any standard deviation of the random variable around the mean value. Therefore, Six Sigma means six times the distance of standard deviation. It is inseparably connected with the principles of TQM. Due to its dynamic character it has become one of the most effective tools in continuous development and pursuit of excellence.

Lean Six Sigma has developed and systematized many statistical and business tools while reducing costs, defects, waste and cycle time of production, and at the time increasing market share, maintaining customers, product development. Its program can be used at every stage of the production and administrative process.

Lean Six Sigma is perceived as a philosophy or concept of a broad sense. Using it as a philosophy helps with changing the world and transformation of an enterprise. Treating it as a strategy ensures development and increases the position of the company. It is based on six main principles which should be implemented in companies that want to develop and increase their position on the market. The very first point is concentration on the customer. Every action, which is taken, should be in agreement with customers' specifications and requirements. It is based on continuous improvement of all aspects of functioning development in the organization as well as proactive management and cooperation without boundaries at every level in enterprise. It should be underlined that it is not only an approach for solving the problems with manufacturing but also business processes.

2. DMAIC cycle

Among many different tools of quality management which may be considered as methods of quality improvement, there are two main ones used in Six Sigma concept: DMAIC and DMADV. DMAIC is an acronym from the words Define-Measure-Analyze-Improve-Control. This method is based on process improvement according to Deming cycle. It is a process improvement of many different areas in the enterprise. DMAIC cycle consists of five stages which are connected with each other:

- Defining the goal and its requirements:
 - ✓ Defining needed resources and responsibilities,
 - ✓ Defining organization structure which is favourable to achieve the goals,
 - ✓ Identification of the elements and setting the estimated date of the end of project,
 - ✓ Obtaining support from management.

The main purpose of this stage is to verify if the actions, which should be taken in order to solve the problems, are connected with the priorities in the organization and that there is support from management and availability of required resources. It starts with identifying the problem which needs a solution and ends with understanding this issues as well as a clear evidence of management supervision. There are a lot of ways how to identify a project for improvement. Firstly, it is better to focus on external factors, which create the cost for organization and take the actions to eliminate them and after that solve the internal-costs problems. A useful tool which helps to narrow the problem can be Pareto diagram.

- Measuring the current process:
 - ✓ Identification of valid and reliable metrics,
 - ✓ Checking if there is enough data to measure,
 - ✓ Documentation of current performance and effectiveness,
 - ✓ Performing comparative tests.

The measure stage concerns gathering information about processes which are going to be improved. It focuses on information which is needed in order to better understand all the processes in organization, customers' expectations, suppliers' specifications and

identification of the possible places where a problem may occur. It may be done by creating a process map of the actual situation and performing failure mode and effect analysis (FMEA) which will indicate the places of possible risk. The main issue of the measure phase is to collect and analyze the data which will be needed in the control phase to show the differences and assess the progress which will be presented to the management. It is also essential to assess the measurement system and to ensure that all data are veritable and collected in a proper way.

- Analyzing the results of measurements, determining the causes of process imperfections and possible solutions for them:
 - ✓ Identification of key reasons for problems,
 - ✓ Identification of the differences between current and target performance,
 - ✓ Estimation of resources required to achieve target,
 - ✓ Identification of possible obstacles.

In the analyze stage different tools and methods are used to find root causes, assess the risk and analyze data. To confirm the analysis some samples should be performed and potential problems have to be proven to be real problems. In this phase it is needed to define process capability, clarify the goals based on real data gained in the measure phase and start root cause analysis which has impact on process variability. By calculating process capability which is defined as “sigma” of the process, ability of the process to meet customers’ requirement is measured. Process capability will be a key point for planned improvements.

- Improving the process, implementing the changes, which eliminates the imperfections:
 - ✓ Preparing the structure of work division,
 - ✓ Developing and testing possible solutions, selecting the best one,
 - ✓ Designing the implementation plan.

The goal of this stage is to take necessary information to create and develop an action plan in order to improve the functioning of the organization, financial aspects and customer relationship issues. The possible solutions for the action plan should be presented and performed. Some kind of pilot solutions, confirming the validity and accuracy of analytical work which allows to make any corrections before applying the solutions on a large scale, are carried out.

- Controlling of the improved process, monitoring the results in a continuous way:
 - ✓ Documentation of the plan of standardization and process monitoring improvements,
 - ✓ Confirmation of the improved procedures,
 - ✓ Transferring the ownership of the relevant teams after the completion of the project.

The control stage is about confirmation if changes implemented at the improve stage are sufficient and continuous by verifying the quality of the improved process. It also controls the future state of the process in order to minimize deviation from the objectives and ensure that the correction is implemented before it would have bad influence on the result in the process. Control systems such as statistical process control should be implemented. The process has to be continuously monitored. In the control phase control charts are used to identify if the process is controllable or not.

Six Sigma allows to implement scientific methods in the organization to deliver the best value to the customers. There are also some additional steps that should be taken in DMAIC cycle:

- Observation of important issues of the business and external environment,
- Development of a hypothesis based on this observation,
- Making predictions upon hypothesis,
- Testing the predictions and further observation, conducting experiments and using statistical methods,
- Repeating two last steps and comparing the hypothesis to the results for observation and experiments.

3. Conclusions

Nowadays, Six Sigma is getting more and more popular among organizations from various industries. It focuses mostly on improving production processes what leads to the increase of profitability of the company. Achieving Six Sigma level requires from organizations understanding the reasons of processes variability, performing their analysis of cause and effect and the assessment of their costs. The application of DMAIC, which is one of the methods of quality improvement used in Six Sigma concept, can increase the effectiveness while adequate reacting for the appearing problems. As it was shown on the example of the machine Kolbus BF 511, it can be achieved by implementing SMED, trainings for employees, work standardization and Total Productive Maintenance and after that, it is necessary to introduce continuous control on the efficiency of the processes performed on that machine. The proposed solutions may bring many different profits not only for the company, but also for other entities involved in their functioning. Benefits of this implementation can be as follows:

- Company - avoiding penalties for non-compliance with the agreement, lower costs of production, increased productivity, and consequently reduced amount of work in progress,
- Customers - increased customer satisfaction due to increased timeliness,
- Employees - increased comfort and better organization, lack of overtime,
- Other - the possibility of taking more orders during the calendar season”

4. References

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