

LEAN SIX SIGMA IMPLEMENTATION IN INDUSTRIAL COMPANIES

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Abstract

Continual improvement, as one of the objectives of a quality management system is achieved by the improvement of all processes and activities at a particular stage of the production cycle. Continual process improvement is also the only way how to survive and succeed among competitors. The management of the company will always be looking for opportunities that will enhance the effectiveness of the company's processes. Lean Six Sigma is one of the significant methodologies of quality management, this seeks to increase productivity and improve quality of process outputs. As a customer oriented managerial strategy, it emphasizes that imperfection is an opportunity for improvement. The Lean Six Sigma system helps to effectively reduce any defective process; it improves the quality of the provided services and makes the management processes more efficient. It focuses on the elimination of waste, thus it focuses on eliminating non-value adding activities. The goal is to eliminate the non-value added activities in order to create continuous flow and shorten the duration of the process. The contribution focuses on some important aspects of implementing the Lean Six Sigma method in industrial companies.

Key words: *quality management, continual process improvement, Lean Production, Six Sigma.*

Introduction

If an organization wants to succeed and be competitive, it must be focused on the customer, it must be flexible to respond to all needs and requirements, such as rapid and unexpected changes in the market. Basically speaking, the organization must provide its customers with high quality products.

Improvement issues related to the development of the global economy are largely important and are in the forefront of strategic thinking of managers aspiring towards success in today's demanding markets. Improving the quality should be seen as activities aimed at enhancing the ability to meet customers' requirements and expectations. Meeting the customers' requirements and expectations cannot only be understood in a condensed plane of technical specifications as quality is absolutely necessary to be understood in connection with such factors as productivity, flexibility, delivery dates, and the minimization of costs. Management is constantly looking for opportunities to improve the efficiency and effectiveness of the processes of the organization, thus being proactive. Improvements may cover a range from small continuous operations to strategic long-term projects of improvement. (Paulová et al, 2010)

One very efficient method of improvement is connected with Lean Production and the Six Sigma strategy. Within the survey, the level of applied basic principles of quality management was queried; continuous improvement was one of them. During the research, the mentioned principles were tried in order to find out which forms of improvement were applied in industrial enterprises within Slovakia.

A total of 135 organizations were contacted, of which only approximately 10% reported the application of Lean Six Sigma. This is considered quite a negative phenomenon, because the success and prosperity of organizations largely depends on appropriate methods applied for their improvement.

The start of Lean Six Sigma in an organization involves a variety of activities. A successful implementation is created with new features implemented with new training and new ways of communication between different levels of the organization

Six Sigma Strategies

The basic principle of improvement by the processes of Six Sigma methodology is by the reduction of diffusion. The Six Sigma philosophy is based on the fact that all processes from design, through to manufacturing and to services provided to customers, display aberrances, which may result in product errors that cost time and money. These errors are variations of processes that can be reduced by various methods in order for the real cause of the problem to be systematically identified and eliminated.

Quality of processes is one of the pillars of Six Sigma. Only stable processes, where performance is reliable and predictable, can provide perfect quality, therefore the diffusion in each process must be minimized. Improvement by the Six Sigma method actively influences process inputs that have a significant impact on performance, quality and the effectiveness of the output. It is assumed that the variation of the output is due to the scattering of the process input. Knowledge of inputs, their level of diffusion and the impact on the output is determined by optimal values and their objective management during the main activities of the project. Solutions for improvement are provided by the Six Sigma method.

A standard procedure of DMAIC steps (Define-Measure-Analyze-Improve-Control), is used during the course of the project. This helps to monitor the progress of the project, to unify the work of various researchers in the company, to help choose the right tools for a given period in this project, but mainly to provide a common language of communication for all involved.

The characteristics of Six Sigma are expressed in the following steps:

- The intensity of the use of statistical methods while building statistics in the life of the company as the skeleton of all the action.
- In particular, this involves top management in the company and not only quality control workers and specialists.
- To solve chosen projects takes extra capacity and the necessary resources.
- Experts and Specialists receive and apply knowledge immediately, even during practice; this knowledge is gained from the training program that has been specifically compiled.
- Six Sigma does not implement major projects for large processes, but gradually and systematically eliminates losses that cause major problems hidden in sub-processes or in different activities.
- Insisting on the evaluation of direct and measurable benefits based on economic business results.

Six Sigma is not just a method of improvement; it reflects the philosophy and strategy of the company. This strategy aims to improve business processes, to reduce faulty products and to increase production processes including managerial, administrative, and transactional processes. This method achieves the highest quality in all activities. This is built on a customer centric organization and substantially improves results. It is based on a perfect understanding of the requirements and

expectations of customers and applies proven tools to eliminate defects in processes, which are designed to meet customer requirements.

The basic principles of Six Sigma strategies are:

1. Focus on customers.
2. Focus on processes.
3. Focus on staff.
4. Proactive management.
5. Management and improvement based on data, information and knowledge.
6. Organization to support Six Sigma.
7. Perfection as a long term goal.

Lean Production

Lean Production is a systematic approach which identifies and eliminates all forms of waste from production processes and gradually reaches a synchronized production flow. This includes elements such as value stream mapping, lean workplace, process improvement (KAIZEN), visualization and standardization of processes, processes of quality assurance at source, manufacturing cells, total productive maintenance, fast casting equipment, teamwork and more. (Ko turiak, 2012)

Lean manufacturing is so concentrated on the elimination of waste in any part of the production. Starting by contacting the customer and accepting his demands, continuing through the supply network, manufacturing process and ending with selling the finished product to the customer, flexibly and economically but at the same time respecting the customers' needs. This does not mean that it is a self invested reduction of costs. It is all about maximizing the added value to the customer.

There were attempts, to eliminate any waste, in Japanese this is called "muda" by the lean manufacturing philosophy. The term muda refers to those activities that do not add value. Muda at a workplace has seven categories (Beňo, 2011):

- *Muda of over-production, when a greater production of products is produced then it is required by customers.* Overproduction leads to wasting of materials, energies and human work.
- *Muda caused by unnecessary stock-* this type of waste is caused by overproduction and purchasing for storage or storage of spare parts, unfinished goods, and finished goods. These items unnecessarily take space and require additional costs.
- *Muda caused by defects* – Whenever defects occur, extra costs are incurred due to re-working a part, rescheduling production, etc.
- *Muda caused by unnecessary movement of employees* connected with the efficiency of their work causes a waste of physical power e.g. when removing staff to get spare parts
- *Muda caused by inappropriate processing, use of the wrong technology* can cause the deficit due to long production launching times and long working operation times.
- *Muda caused by waiting* – wasting in consequence of lack of components, consumables and equipment or because of a damaged machine or unstable production.
- *Muda caused by transport* – transport is an inseparable part of the production processes which cannot be removed, however it does not give any value to the final product and this is why the aim is to reduce it to the lowest possible level.

Lean Six Sigma

Recent trends in quality management philosophy suggest combining Six Sigma with the Lean method. The Six Sigma method is an effective tool for improving the quality of processes. The Lean method has efficient tools which speed up processes by eliminating losses and wastage. Rapid improvement requires both approaches and their connection is necessary for the following reasons:

- Lean processes can not go under statistical control,
- Six Sigma cannot dramatically improve process speed or reduce the need for capital investment.

The application of Lean Six Sigma is also related to the reduction of production costs. Companies are trying to reduce production costs while maintaining the desired properties of the products required by customers. Quality is thus not only found in the product but also in all processes that are performed in the company. It is important to invest in improving process capabilities and to expedite the process. Streamlining of processes has a significant impact on the quality of outcomes, either in terms of cost, time or quality.

The application of Lean Six Sigma helps to increase profits. It is the market that determines the retail price and not the company. Often the only way to increase profits is to reduce costs. Lean Thinking (Lean) is to eliminate everything that does not bring value to the customer and everything that does not add value to the product, it also eliminates variables that increase the cost of production. Reduction of process time and the varying duration of a process is as important as the reduction of variability in quality.

Methodology of Research

Today more than ever, each company, not just any company in Slovakia, should realize that suitable configured processes are the basis for its competitive presence in conditions of the market mechanism. Law implementation and the management of processes are implemented through building quality management systems. Quality management systems are based on the application of eight quality management principles. The purpose of the survey was to examine the level of applied fundamental quality management principles, including the principle of continuous improvement.

A study was conducted by a questionnaire. The questionnaire was completed by 135 organizations in various industries focusing on production or service activities. 87% of the surveyed organizations had a quality management system implemented and 13% had no system implemented at all.

In the following companies only those with an established quality system were considered and the results were elaborated separately for the automotive industry, engineering industry and enterprises from other industries. In future the companies, with QMS will be considered and achieved results will be divided in automotive industry, engineering industry and enterprises from other industries. The questionnaire was completed by 124 Slovak enterprises, which can be organized into the following industrial groups: 35 % automotive industry, 35% machine industry, 30% other industries.

The data gained from the questionnaires was elaborated and evaluated by mathematical and statistical methods which mostly express the frequency and percentage of responses.

The methods of analysis and synthesis were used in obtaining the information. When reviewing the status of implementing quality management principles in practice, content-causal analysis together with the method of abstraction were used. Conclusions from the application of quality management principles in practice found via the questionnaire survey were made.

Research Results

In research about principles of continuous improvement there was an attempt to find out which form of improvement was applied in industrial enterprises in Slovakia.

Processed results showed differences in their application of forms or methodologies of improvement between enterprises of different industries (see Fig. 1). The survey showed that the vast majority of organizations use gradual improvement KAIZEN; the second most common form of improvement was Global 8D, followed by Lean Six Sigma, VW.

Compared with other forms of improvement the methodology of Lean six Sigma was applied in 12% of companies in the automotive and machine industry. In other industries there was an approximate improvement of 16%. It is considered quite a negative phenomenon, because the success and prosperity of organizations largely depends on appropriate methods applied for their improvement (Vaňová, Kučerová, 2010).

It is surprising, that only a small percentage of companies in the automotive industry are applying the Lean Six Sigma methodology. Based on the fact that, in these companies the application of basic quality management principles is on a higher level than in other industries, there was the assumption that progressive forms of improvement will be applied in the automotive industry in a greater scale.

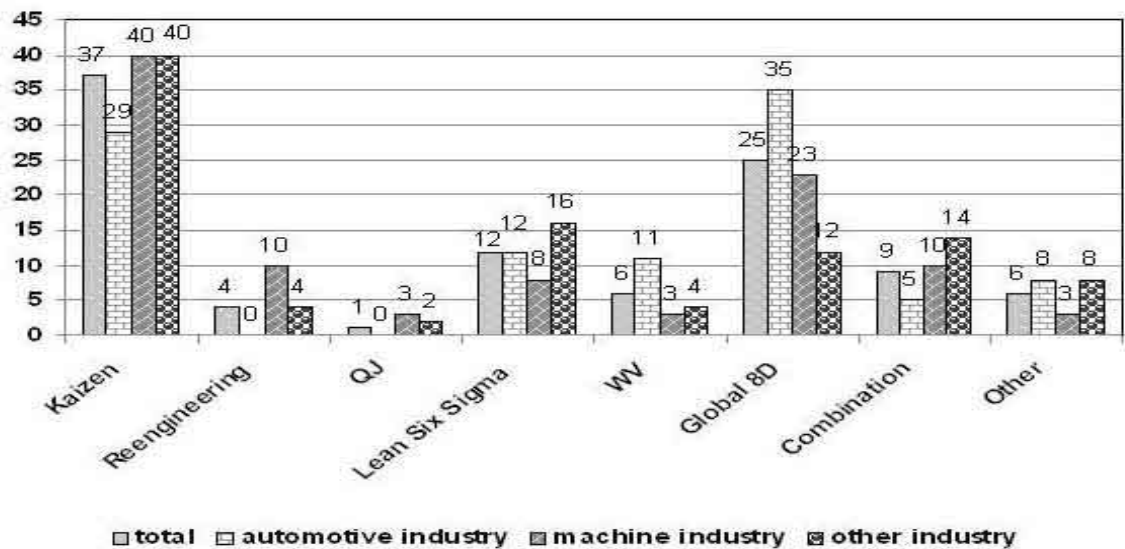


Figure 1: Results from research about forms of quality improvement in praxis.

In the context of the process of improvement, we also dealt with the use of statistical methods in analysis and evaluation of data, which can be considered as a basis for process improvement. From the results of the research it is obvious, that almost all the surveyed companies use some statistical methods, although their application are on different levels, as shown in fig.2.

In this case, it should be noted that the use of statistical methods should not be considered as a formal order to implement these methods, but a prerequisite for the successful application of any form of improving various processes. The use of statistical methods should be considered as an offer of tools that enable the enterprise to improve the economy by the cheapest method, to identify weaknesses in all main stages, continuously improvement of quality, to achieve stability and to statistically manage the process, which prevents non-conforming products from contributing to higher quality at lower prices, thus giving customer satisfaction.

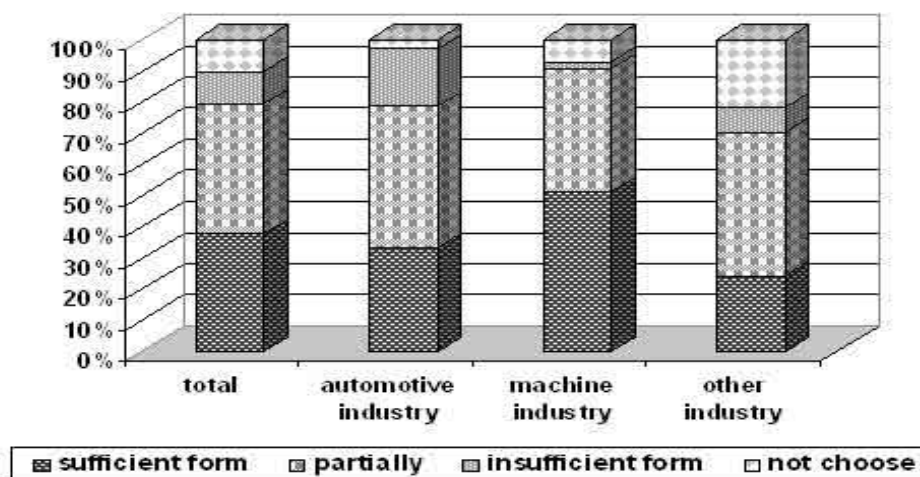


Figure 2: Results from research about application of statistical methods.

Discussion

Every customer expects quality, speed and low cost. The process that produces a lot of errors cannot be fast. If an organization wants to achieve the highest levels of quality, it must do what contributes to the speed of processes and thus eliminates the delay. Low quality and low speed is what makes the processes and thereby also products and services costly. (George, 2005)

We agree with that view and we conclude that the only way to consistently offer the lowest price and still make a profit is to improve the quality and speed. Thanks to the mentioned bindings is Lean Six Sigma better in comparison with other improvement methodologies. Combining of these two approaches can be obtained very effective tool for improving in the form of Lean Six Sigma.

Paulová (2010) says, that in many companies there are good conditions and assumptions for use of these methods, because those that have a quality system, know several tools and methods of the quality management and specific methods of improvement that are applied. Lean Six Sigma does not require the application of new methods and techniques, but expects effective application of proven methods, consistently and correctly. The important factor for the success of this methodology is the involvement of employees, especially top management and eligible members of research teams.

The start of Lean Six Sigma in an organization involves a variety of activities. Its successful implementation in a company is created with new features implemented with new training and new ways of communication between different levels of the organization.

The successful implementation of Six Sigma quality management in an organization leads to process variations, quality and productivity improvement. The bottom line results in improvement & a competitive position of the industry. Six Sigma DMAIC methodologies are beneficial to improve productivity and quality of the organization. The DMAIC methodology is applicable in both, the manufacturing and non-manufacturing sectors. Six Sigma is a new strategic paradigm of management and has been created for an organization to survive in the 21st century. (Pathak & Desai, 2011)

Conclusion

Lean Six Sigma is an approach that learns from past failures, one of them is insufficient support of management. In organizations where Lean Six Sigma has an emphasis on improvement, this starts with top management.

Focus on customers, processes, employees characterize the Lean Six Sigma as a method of building and developing a new corporate culture and providing organizations with a tool for a competitive advantage.

Approaches for improvement based on Six Sigma and Lean, in recent years have proved as effective in successful companies. The application of these concepts is particularly useful where there is a strong customer orientation, cost, quality, time and performance processes. The integration of these two principles are logical and practical which can bring dramatic improvements, as it is indeed possible to achieve the lean processes without statistical control of variables, since it is not possible to achieve a 6 Sigma process level without optimal flows and the elimination of waste.

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