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FEATURES OF LEAN SIX SIGMA

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Abstract

It is considered the essence and features of the Lean Six Sigma as a way of improving business processes at enterprises. The aim of the study is to demonstrate the key aspects and features of the Lean Six Sigma, which is used to improve the quality and efficiency of production processes at enterprises. The methods of analysis, analogy and comparative analysis are used to achieve the formulated goals.

The approaches of quality management as the basis of this methodology are considered. Lean management, which focuses on the elimination of redundant processes and minimizing losses, and Six Sigma, which is aimed at reducing the variability of processes, improving them through the elimination of defects and improving predictability. The shortcomings of individual concepts and the advantages of their synthesis are analyzed. The advantages include a constant desire to reduce losses and improve quality, focus on customer needs, and participation of all levels of employees in process improvement. The implementation of Lean Six Sigma affects both economic growth and the improvement of the atmosphere within the team. The importance of personnel training for the successful implementation of the methodology is emphasized.

The role of Lean Six Sigma in modern business is determined. Examples of successful application of the methodology in various fields and benefits from its use are given. The practical significance of the study is to provide recommendations for companies to implement this concept to improve the quality of their processes, achieve success and competitive advantage are provided.

Keywords

Lean Six Sigma, Lean management, Six Sigma, processes, management, quality, improvement, enterprise.

Problem statement

The main goal of every enterprise is to find ways to manage their business process in the most efficient way. Also, they try to save time and resources while simultaneously increasing the level of customer satisfaction and quality. This goal is fully relevant, as the conditions of the external environment are extremely changeable and unpredictable. Therefore, even those tools that today give an excellent result must be constantly improved. They take into account changes of many factors. The Lean Six Sigma methodology is one of such relevant tools.

Relevance of the chosen topic

In the modern world the conditions for doing business are constantly changing. Organizations have to find effective and innovative ways to improve quality, productivity and competitiveness. Lean Six Sigma is a concept that allows to achieve these goals, so there is a need to study the feasibility of its implementation at modern enterprises.

Analysis of recent research and publications

Many outstanding foreign and domestic scientists were engaged in the research of this topic. According to the point of view of Inna Kuznetsova and Valentina Horbatyuk (Кузнецова& Горбатюк, 2018), Lean management is focused on reducing or eliminating unnecessary costs, as well as increasing the value of the product for consumers. According to Łucasz Dekier (Dekier, 2012), Lean management also pays important attention to aspects related to human resources in the company.

According to the vision of Iryna Fadeeva, Natalia Orlova and Victoria Makarova (Фадєєва, Орлова & Макарова, 2023), Six Sigma consists in improving the productivity of business processes to reduce the number of possible defects and improve quality. In addition, according to Volodymyr Dubnytskyi, Natalia Naumenko, and Oleksandra Nefedova (Дубницький, Науменко & Нефедова, 2021), the principle of the Six Sigma concept begins precisely with the definition of consumer requirements.

Pankai M. Madhani (Madhani, 2020) and M Vijaya Sunder (Sunder M, 2013) point out that in modern market the integration of previous methodologies provides quite significant synergy, so the concept of Lean Six Sigma, with its flexible nature, is a more competitive approach. Similar views are also held by Svitlana Bondarenko (Бондаренко, 2022), Nataliya Gryshina, Larisa Gryshina (Гришина, Гришина & Звіришина, 2018) and Oksana Zelenko (Zelenko, 2018). They believe that "Six Sigma + Lean management" is the most optimal combination of concepts for improving the quality of processes and their speed.

Purpose of the article

The aim of the study is to demonstrate the key aspects and features of the Lean Six Sigma methodology. It is used to improve the quality and efficiency of production processes at enterprises.

To achieve the formulated goal, it is necessary to solve the following tasks, such as:

- study of the essence of the Lean Six Sigma methodology and the methods underlying it, that is, Lean management and Six Sigma;
- consideration of the main principles of the mentioned concepts;
- analysis of advantages and disadvantages of the methodologies;
- development of recommendations for the implementation of Lean Six Sigma at modern enterprises.

Presentation of the main research material and results obtained

Lean Six Sigma is a combination of such original systems as Lean management and Six Sigma. Lean management focuses on the elimination of redundant processes and minimizing losses. Six Sigma is aimed at reducing the variability of processes, improving them through the elimination of defects and improving predictability. These proven and well-known methods of management and optimal setting of the production process harmoniously and quite effectively complement each other. To begin with, consider these two concepts separately.

Lean management is a method of managing processes and labor organization aimed at increasing the company's efficiency, that is, increasing profitability (Баранов, 2021, p. 79). This is achieved thanks to the optimization of production and business processes, namely in the form of a reduction in the time of tasks that do not affect the cost of the product. In addition, working conditions for employees should be constantly improved.

The word "lean" is used precisely in the sense of "no frills", implying the rejection of losses and unnecessary elements of the process. They lead to errors, complicate work and reduce its efficiency.

There are 7 main types of waste within Lean management, which are shown in the Figure 1.

Fig. 1. The seven types of waste within Lean manufacturing
Source: "7 Types of Waste in Lean Manufacturing", 2021

According to Figure 1, we can distinguish the following types of waste:

1. Excess Motion (this refers to both human activity and the aimless movement of machines in the company).
2. Transport (excessive transportation from place to place without a specific purpose).
3. Unnecessary Inventory (minimizing inventory is very important, because too much inventory in the warehouse can lead to expensive disposal due to, e.g., falling sales).
4. Waiting (functioning processes are inefficient, e.g., waiting for one's turn in a process can cause delays).
5. Overprocessing (this can be related, e.g., to printed documents that do not create additional value for the customer).
6. Overproduction (this is the most common waste of manufacturing companies, which refers to excessive load of machines that does not match the current demand).
7. Defects (improperly manufactured products, e.g., under time pressure, which do not meet the customer's requirements; lack of effective communication between departments).

The idea of Lean management originated in the Japanese manufacturing industry. It was based on the concept of Lean production, which was developed by an engineer of the Toyota company in the 1950s. It was established in order to reduce defect, waste and wastage during the production of goods to solve the energy crisis in the country and the company ("A Brief History of Lean - Lean Enterprise Institute", n.d.). A loss in Lean management is a waste of resources that does not add value to the consumer. An important element of the Lean management concept is that it involved every employee in the optimization process and became as customer-oriented as possible.

It should be noted that Toyota was initially a small car manufacturer, so the specifics of its operational process quickly caught on. Subsequently, these innovations found recognition among many companies and were used by them in their activities.

Nowadays, Lean management is widely used by many of the world's leading companies, e.g., Intel and Nike. Thus, this concept is considered a more advanced business strategy. It borrowed elements of its predecessors and adapted to the demands of the modern market.

In order to successfully implement Lean management in the company, it is necessary to take into account its following principles (Dekier, 2012, p. 48):

- determination of value (quite a lot of actions have no meaning for the consumer, so it is advisable to get rid of them);
- optimization of the most important processes (it is necessary to draw up a scheme for the formation of real value in order to avoid unnecessary losses);
- ensuring a continuous production process (complex tasks should be broken down into smaller ones; communication between departments should be improved to ensure the fastest execution of operational tasks without compromising quality);
- production according to demand (it is necessary to produce only those products and precisely in those quantities in which consumers need them);
- striving for perfection (it is necessary to make sure that the other four principles operate continuously and consistently).

Implementing Lean management can be started by using the tools shown in Figure 2.

Fig. 2. The main tools of Lean management
Source: compiled by the authors

Six Sigma is a concept of production management that focuses on enhancing work and production processes by identifying and eliminating defects within them. The reference points are those parameters that hold the utmost significance for the consumer (Council for Six Sigma Certification & Setter, 2018, p. 8).

The inception of the Six Sigma methodology can be attributed to the Motorola Corporation in 1986 once it began to get mass complaints. They were connected with the large number of production defects found in the goods. This concept achieved its popularity after the 1990s since Jack Welch made it the principal strategy of General Electric (Фадєєва, Орлова & Макарова, 2023). Today, it is widely used by companies such as Ford Motor Company, FedEx, Caterpillar Inc, etc.

In our view, in today's environment, Six Sigma has transformed into a broader business management philosophy. It emphasises the fulfillment of customer requirements, the enhancement of customer retention, and the improvement of products and services.

This approach incorporates statistical methods and quality management techniques. Also, it includes a tool for measuring results and special working groups. Their purpose is to eliminate problems and enhance business processes (Council for Six Sigma Certification & Setter, 2018, p. 8).

In contrast to Lean management, the application of Six Sigma is guided by the following principles (Лазаренко & Гарафонова, 2021, p. 304):

- to make work processes predictable (that makes it easier to control them);
- to make processes simple for analysis and modifications;
- to engage all working groups;
- to set goals using the SMART method (specific, measurable, achievable, relevant, time-bound goals);
- to make decisions only on the basis of analysis.

The rule of this concept indicates that that the expense associated with an undetected defect rises as the series of business processes progresses. As a result, rectifying a defect identified during the initial stages of production is significantly less costly than rectifying it when it is directly noticed by consumers. Therefore, Six Sigma is implemented gradually following a system "DMAIC" (Zelenko, 2018, p. 60). Its decoding is shown in the Figure 3.

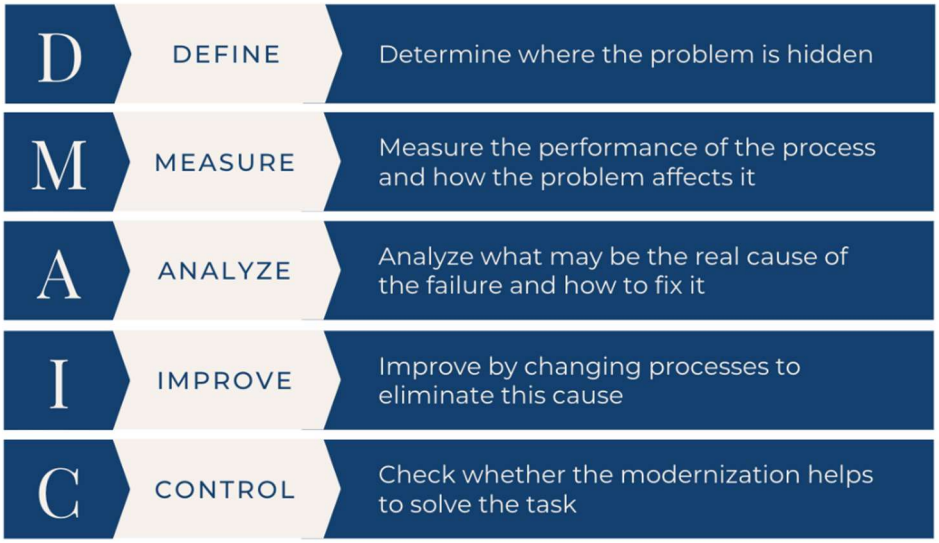

Fig. 3. The decoding of the abbreviation "DMAIC"
Source: compiled by the authors

In addition, Six Sigma incorporates techniques and tools that go beyond the realm of change management, e.g., business process mapping, cost-benefit analysis, brainstorming, CTQ tree, etc. During the stage of implementing changes, however, this methodology necessitates the utilization of other tools. Some of the most frequently employed ones include the Pareto curve, Shewhart control chart, regression analysis, variance analysis, and more (Fig. 4).

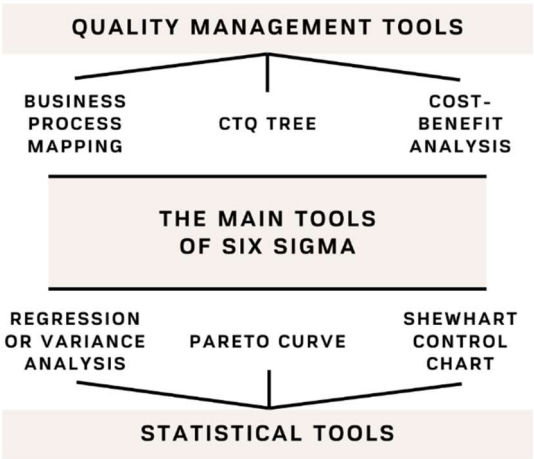

Fig. 4. The main tools of Six Sigma
Source: compiled by the authors

The management approach of Six Sigma bears resemblance to Eastern martial arts. The role of the performer is determined by his belt level, signifying his knowledge and skills:

1. At the apex of the hierarchy is the company's management. It allocates responsibilities and resources. Top management is responsible for eliminating internal corporate barriers and addressing staff resistance to change.
2. Champions implements Six Sigma within the organization and mentors the Black Belts.
3. Master Black Belts are responsible for supervising and guiding the implementation of Six Sigma, while also providing leadership to the regular Black Belts.
4. Black belts under the supervision of the masters are responsible for project execution and completing assigned tasks.
5. Green belts, in addition to their duties, actively participate in implementing the methodology.
6. Sometimes there are White and Yellow Belts – employees at the initial level of Six Sigma knowledge – who either partially contribute to the project or observe the actions of more experienced colleagues.

The described hierarchy is schematically depicted in Figure 5.

Fig. 5. Six Sigma belts hierarchy
Source: compiled by the authors

Given that each of the two approaches possesses certain drawbacks, by integrating these concepts, a system with a synergistic effect was created. That is, Lean Six Sigma mentioned at the beginning. It can be applied at any enterprises regardless of their field of activity and size.

The experience of using a complex synthesized process was first described in 2001. After 2 years several books were published with a detailed review of the theory and practice of Lean Six Sigma. As a result, it became clear that the two concepts conditionally divided all procedural diversity among themselves: Lean management defines what needs to be accomplished, and Six Sigma explains how to organize activities.

A notable aspect is that by the end of the 20th century, both of these concepts, Lean management and Six Sigma, became highly sought-after areas of business consulting in quality management. They exhibited a higher success rate of their implementations compared to other methodologies. At the same time, in combination, they demonstrated even greater efficiency.

If we talk about the global advantages of using a symbiosis of Lean management and Six Sigma, then their list will look like a puzzle, where the shortcomings inherent in the Lean methodology are successfully complemented by the Six Sigma methodology (and vice versa).

To begin with, let's explore how Six Sigma enhances Lean management. Firstly, Lean management does not specify the requirements for the infrastructure needed to implement the concept. Resolving this issue depends on the initiative and organizational skills of the managers. However, when their composition is changed, difficulties with the transition may arise. Therefore, Six Sigma helps to formalize the obligations of the company's top management, to establish a plan for resource allocation and control over the absorptive capacity.

Secondly, the emphasis on customer demands is not clearly defined in the Lean management concept. The fulfillment of these requests indirectly depends on reducing production costs and non-production losses, while in Six Sigma all its key points are related to tracking the relationship between "characteristics of the production process" and "the level of satisfaction of the end user".

Thirdly, while Lean management identifies defects as the primary sources of production losses, the

concept of Six Sigma provides statistical management methods for their elimination.

Now consider the reverse situation, that is, how Lean management complements Six Sigma. Firstly, Six Sigma focuses on methods for eliminating defects. However, in addition to this factor, Lean management also takes into account various non-value-added activities such as waiting, transportation, overproduction, inventory, and unnecessary movement of people.

Secondly, Six Sigma fails to address the relationship between customer satisfaction and process duration. However, Lean management introduces the crucial aspect of "time." Moreover, Lean management broadens the scope of tasks covered by Six Sigma by incorporating the elimination of non-value-added activities, workplace optimization, inventory reduction, and cost reduction in transportation, among others.

At the same time, both fundamental systems share a focus on individual processes, which remains a distinctive feature even in the combined concept.

Based on these observations, it becomes evident that the adoption of Lean Six Sigma has a dual effect, impacting both economic growth and improvement of the atmosphere within the team.

Thus, the use of an integrated concept (Madhani, 2020, p. 9-10):

- speeds up processes by 20-70%;
- improves the quality of services provided and products produced by 20-40%;
- increases the overall efficiency by 10-30% (compared to the separate use of one of the two basic concepts).

Such results can be expected if there are losses in the production process that can really be avoided. Their presence is evidenced by the fact that the company frequently expands or downsizes production, increases product variety, implements organizational innovations, etc. It is also possible to work on eliminating losses if production processes are poorly documented and employees do not fully understand their essence.

When considering the advantages of implementing Lean Six Sigma at modern enterprises, it is important to acknowledge that there can be unexpected challenges in its application. The "human factor" becomes influential, internal conflicts may arise, the statistical process becomes an end in itself, and not a method of detecting defects. Overloading with unnecessary tasks is also mentioned among the common mistakes. In such instances, it is better to focus on the customer's critical needs, selected using a list of priorities.

Therefore, in our opinion, the main principles that will help a project based on Lean Six Sigma to achieve success can be the following:

1. The main focus is the satisfaction of the client's needs.
2. There is a need to develop value in the company's product for the client, and discard what does not create value. The key to success is collecting data to identify a specific problem and combat it. The reasons for defects and customer dissatisfaction are often not obvious, but it is important not to tackle everything at once.
3. It is necessary to improve communications, monitor the results and, if necessary, adjust them. All participants in the work process have to know the basic principles of Lean Six Sigma, otherwise there will be no progress. At the same time, it is worth encouraging and motivating employees for their personal and professional growth.

In addition, skill levels in the Lean Six Sigma methodology are partially borrowed from Six Sigma (Fig. 6).

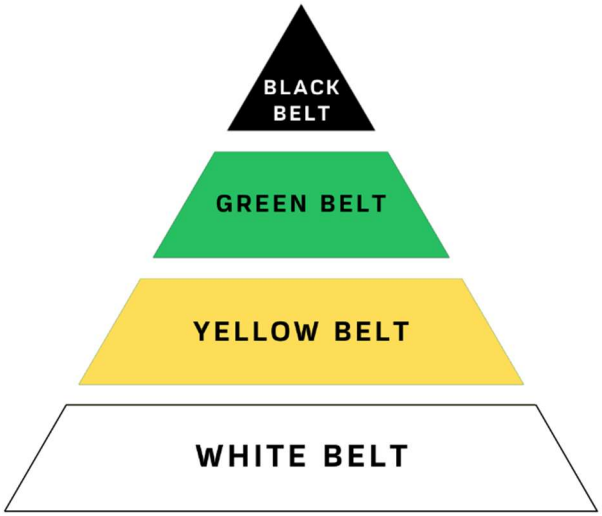

Fig. 6. Skill levels in the Lean Six Sigma methodology
Source: compiled by the authors

According to Figure 6, the following 4 skill levels can be distinguished:

- "Black Belt": a person who will become a strategist in the company and will globally lead the implementation of Lean Six Sigma;
- "Green Belt: people who are the main driving force behind the implementation of the Six Sigma concept;
- "Yellow Belt": work under the authority of the "Green Belt", performing narrow specific tasks in which they can and should be real experts;
- "White Belt": a sign that a person has mastered the basic set of knowledge and understands what Six Sigma is.

It is no exaggeration to say that the use of Lean Six Sigma methodology will be useful and profitable for almost all companies. That is, not only for those who are on the verge of bankruptcy, but also for those who want to occupy leading positions in the market. Today this combination of methodologies is widely used by such companies as Starbucks, Coca-Cola, WalMart, AT&T, as well as our Ukrainian companies "Kyivstar", "АТБ", etc.

Thus, this management method should be used by the companies depicted in Figure 7.

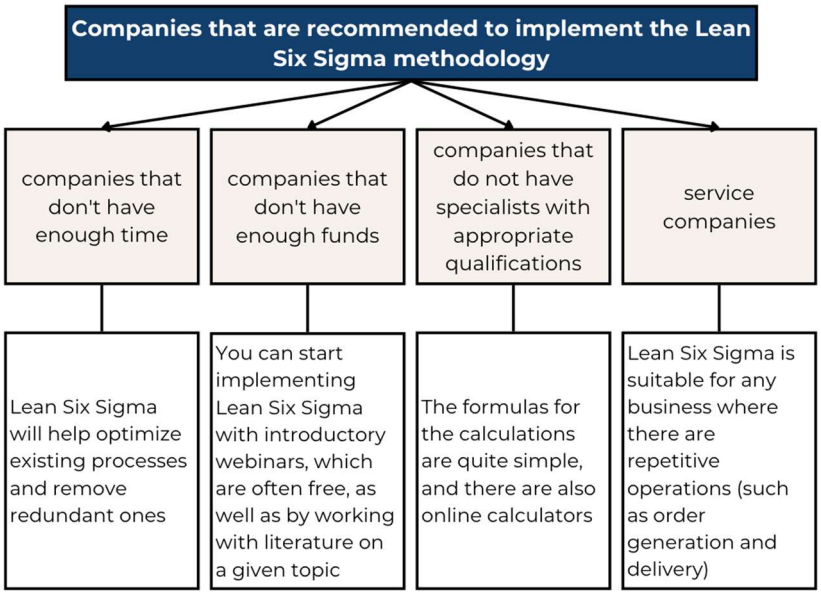

Fig. 7. Companies that are recommended to implement the Lean Six Sigma methodology
Source: compiled by the authors

Thus, according to Figure 7, the use of Lean Six Sigma will help these companies to optimize business processes and save money.

Conclusions

We would like to emphasize that even the most effective and time-tested tools must eventually change, improve, adapting to the realities of the market and the companies represented on it. A clear example of this is Lean Six Sigma. It is to some extent an innovative combination of process management methods, based on the principles of Lean management and Six Sigma. It is emphasised on the fact that they can be successfully used not only in production, but also in any area of business.

Based on the presented facts, it can be concluded that the Lean Six Sigma methodology is a solution for companies which use modern effective instruments. At the same time, they receive permanent competitive advantages even when the rest of the market participants are still hesitating about the feasibility of implementing a new methodology. As practice proves, this concept helps companies to achieve impressive growth rates, regardless of the initial operating conditions.

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