

# Lean management: tools and techniques and how to implement them

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## Abstract

The economic system, technology and globalization dictate new conditions and rules on the market. The traditional management model will not provide maximum profit and will not allow companies to adapt to current trends. Tools, techniques and methods developed over the past few decades and their correct use can be used to manage business more efficiently. Lean management focuses on optimizing existing processes, preventing new problems and skilful use of human resources. Therefore, it is of great importance in an extremely competitive modern world. A bibliographic study on various lean management practices and methods of their implementation has been presented. The conclusions of the bibliography analysis indicate that soft skills, efficient management and IT technologies can be the next stage in the development of the concept of lean management.

## Keywords

lean, management, manufacturing

## Introduction

Nowadays, the market is changing immediately. This is due to, not only, widespread globalization, but also rapid technological development. The challenge is to meet the ever-changing needs of customers more efficiently and cheaper. Improving production processes, eliminating waste and building the company's reputation are the main goals that we can achieve using the right set of tools. The use of modern and innovative tools has become a necessity in solving increasingly multidimensional problems. Changes that occur in production technologies or IT technologies result in the continuous emergence of new methods that cover more and more areas of enterprise functioning. The search for new solutions in this area is

caused by radically changing trends in the organization of production processes. For example, we can observe now:

- minimizing the order cycle,
- shortening production cycles,
- custom production, not stockpile,
- a large variety of products manufactured (customization),
- production of small lots or even individual lots,
- low repeatability of produced batches of products, etc.

It is therefore important to consider - how to choose the right methods to meet the needs of the company, how should they be implemented, how to overcome obstacles encountered when introducing new products [Pałucha, 2008, p. 71; Urban, Rogowska 2018, p. 399]. The article aims to present the general characteristics of the lean concept, tools, techniques and methods as well as the possibilities of introducing and applying them in the enterprise.

## **1. Definition**

Lean management is a concept of business management, which assumes the use of many available tools, methods and techniques such as: standardization, group work, customer orientation, striving to flatten the organizational structure, continuous premodifying and improvement (Kaizen), avoiding waste, eliminating the causes of error, continuous material flow according to the Just in Time (JiT) principle and total quality management (TQM). In addition to the management methods and techniques mentioned above, the tools supporting lean management also include: 5S, SMED, Poka Yoke, FMEA, TPM, SixSigma, SPC, Hoshin and Kanban [Urban, 2017 p.33; Jakubowski et al., 2017, p. 19]. It allows you to solve increasingly complex problems and achieve greater profits at a relatively lower cost.

## **2. History**

Development of the concept of lean management was based on solutions and techniques used for the first time at the turn of the 1940s and 1950s. The process of introducing and experimenting on the concept was caused by economic and political conditions in Japan, which after World War II, struggled with such problems as lack of access to raw materials needed for production. Imports from the West have become very limited due to customs barriers. As a result, Japan had to start pro-

moting entrepreneurship and domestic industry among its own citizens, including through educational, organizational, and technical-technological support from the United States.

The Toyota Motor Company pioneered a new approach to production based on high quality, elimination of waste, continuous improvement and flexibility. Attention to detail, high demands on work culture and commitment are Toyota's pillars. The ingenuity, high competence and intelligence of the managerial staff who developed the set of techniques and tools for the Toyota Production System (TPS) were reflected in the development and further fate of the company [Bird, 2002, p. 450]. Taiichi Ohno, Toyota production engineer was the main originator of the lean concept [Sobczyk, 2006, p. 6]. Above-average commitment, perseverance and a great mind allowed him to do this. He gained knowledge from various publications, including H. Ford's *Today and Tomorrow*. He tracked and learned about Ford's operations in Detroit, translating this into his production facilities. Through the way of experiments and continuous improvement, he became one of the main characters responsible for the creation of Lean Management [Shimokawa and Fujimoto, 2011, p. 5].

The author of the concept of "lean production" was John Krafcik, who in 1988, in the "Sloan Management Review" used this term in an article on the study of the International Motor Vehicle Program (IMVP). The study aimed to contrast traditional mass production, which is characterized by, among others low production variability, very high production volume with the system used by Toyota [Krafcik, 1998, p. 44].

The concept was perfected in practice before it became a fully comprehensive management system. Initially, it was known only in Japan, then it was copied by other Japanese car makers like Hino Motors, Daihatsu, Nissan and Mazda. A landmark event for the global popularization of lean management was book *The Machine That Changed the World* published in 1990 by Womack, Jones and Roos. It summarized the results of thorough tests that were carried out in 52 factories in 14 countries. They were intended to explain the differences in quality and level of performance between Japanese car manufacturers and their competitors from Europe and the United States. Initially, it was assumed that better production results were caused by cheap labour and advanced automation, but after analysing the research, it was found that the reason for higher competitiveness was the management system of Japanese companies (mainly Toyota). Japanese automotive companies were characterized by less needed raw materials, human effort and production space in twice as fast time [Womack et al., 1990, p. 11, 14]. It is worth noting that lean management was a feature of large automotive companies in the past, but as

the market developed, it spread to other industries and smaller specialized enterprises [Pearce and Pons, 2013, p. 7].

### 3. Traditional vs. lean approach

Before proceeding to discuss techniques and tools, I would first like to analyse the ways of thinking of the followers of traditional and lean management methods. A change of mind set and approach can be equally useful in transforming our company or our services. Analysing the Table 1, shows that traditional thinking, often, involves focusing on income, not profit. Theoretically, every entrepreneur should be aware of this, and yet despite large revenues, the profit may sometimes be insignificant due to the costs that it incurs during production or shortly after. Lean assumes the elimination of work or activities that are not profitable. In the case of traditional thinking, the emphasis is on optimizing the added value of work and combating the problems that arise.

**Tab. 1.** Basic differences between lean management

Traditional	Lean
Revenue-focused	Margin-focused
Improvement focus: optimizing value-added work	Improvement focus: eliminating non-value-added work
Fire fighting is rewarded	Fire prevention is rewarded
Focus on financial metrics & lagging indicators	Focus on operational metrics & leading indicators
Suboptimization is rewarded	Value stream performance is rewarded
Specialized workers organized by function	Cross-trained workers organized by value streams
Complexity is the norm	Simplicity is the norm
Non-visual workplace / management	Visual workplace / management
Dynamic schedule and priorities	Static priorities and schedule
Unclear ownership & accountability	Clear ownership & accountability
Expensive reviews and approvals by leadership	Decisions are made by those closest to the work
Improvement identified by management	Improvement identified by workers

Source: Koenigsaecker G. (2012), *Leading the Lean Enterprise Transformation*, Productivity Press; 2 edition, p. 106.

Thinking according to the lean concept suggest not to waste money on fighting the same problems, but to go a step further and try to develop a way to prevent

problems. This is probably associated with higher costs, but for the longer period the investment pays off. The approach is also different for employees. Employees do not always have to work in an area where they are specialized. Sometimes it is worth training such an employee, because in this way we can use his hidden potential. A great example here is Google, which gives its employees one day in week at work, in which they can spend their time to whatever they want. They can do things they don't do on a daily basis. This increases creativity, gives the opportunity to work in a group and increases the opportunities for people who are already bored in their everyday position and feel that they would do something else [Koenigsaecker, 2012, p. 107] That is why the implementation of the lean concept should start with a change in thinking.

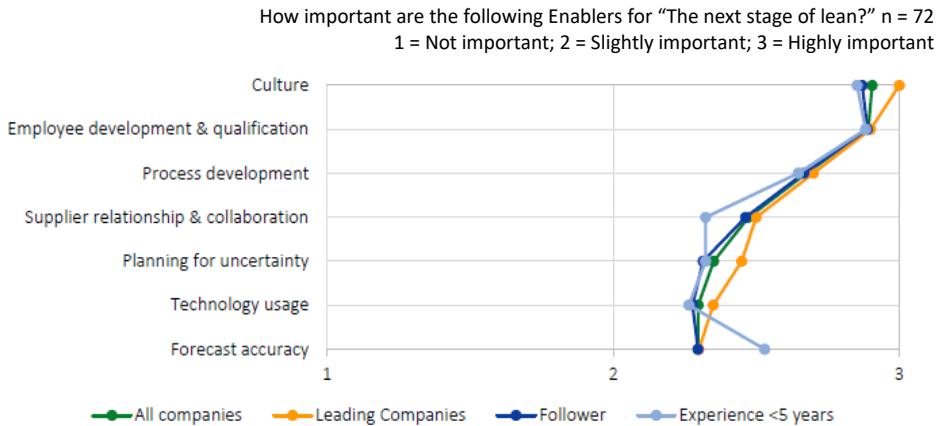


Fig. 1. Importance of factors for “The next stage lean”

Source: *Benchmarking – Lean 2020 – The Future of Operational Excellence*, 2018, <http://tectem.ch/content/2-news/20180920-lean2020/report.pdf>, [05.02.2020], p. 25

According to Figure 1 the most important factor for further development of a company with the lean principle is culture. The concept of culture can be interpreted as commitment and motivation for continuous action. Development, appropriate qualifications and predispositions for further development are closely related to culture. Employees through their professional life will be forced to undergo training in the use of new technologies or skills to maintain the lean philosophy. This proves that technology alone is not enough to get more performance. Only in conjunction with a qualified team and motivation can new technologies contribute to greater business efficiency.

Another survey conducted among people in managerial positions shows that for 91% of respondents, continuous employee improvement is the most important thing. Quick error elimination (87%) is next [Grzelczak and Werner-Lewandowska 2016, p. 202]. Research confirms managers' awareness that every process can be improved and the issue of gaining a competitive advantage will result from better good staff who can adapt to new situations and possible changes in the company [Urban, Krawczyk-Dembicka, 2017; Tomaszuk 2017; Kuc, Moczyłowska 2009].

#### **4. Lean principles and how to support them**

In the publication “*Lean thinking*” Womack and Jones claim that by managing your company based on five basic principles we will become lean. The first principle is to define customer value. You need to gain a deep understanding of the client and the problems that may be encountered. The company should delve into the subject of interest and get deep understanding about specific needs. If the customer wants to buy a car, company should deduce whether he wants any car, whether he wants a specific one, whether car must have any specific parameters and whether, besides the car itself, he also wants nice service. The company must understand that customers only want to pay for things that bring added value to their purchase, so based on in-depth analysis, they should develop and produce products that will be in demand, and customers will be ready to pay for them. The second principle is focused on identifying the value stream. The principle includes value chain analysis and identification of positive and negative activities. The next step should be to reduce the share of non-value-enhancing activities. In this way, the process can be simplified and optimized. The third principle is to organize the flow as smoothly as possible. Production stages or the order of tasks (in the case of services) should be ordered in sequential order, thanks to which we can avoid storage, and the product will move smoothly from one stage to another. The premise is to look horizontal at the process of creating value added and to analyze it from beginning to end. Optimization should occur individually at each stage of the process.

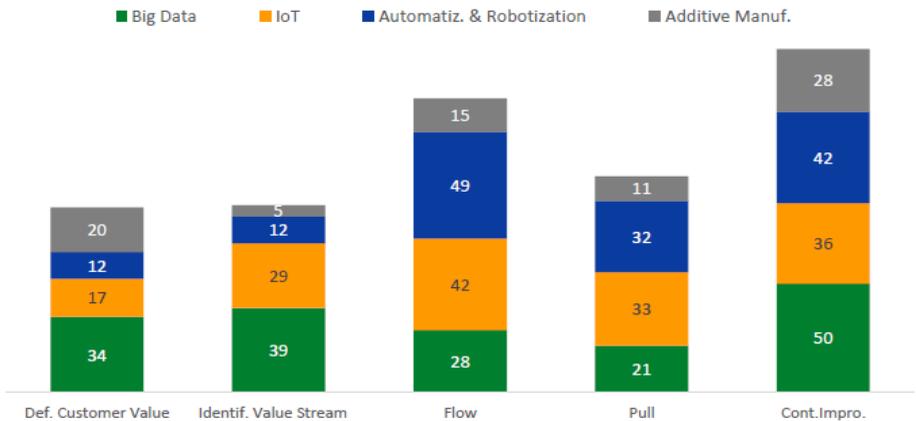
Pull is another principle. It is a system consisting in the production of products or services only when they are needed for the next stage of the process or when there is demand from the client. Following the example of a car, we should not produce it in such quantities that it then stays in the warehouse losing its market value and bearing the costs of storage. The introduction of this rule results in a shorter duration of the task and reduced storage costs.

The last rule is to constantly search for perfection, not to constantly correct mistakes. Obviously, achieving this goal is impossible, but it is more about a pro-

cess of continuous improvement and attempting to create new improvements. The whole lean approach assumes a constant pursuit of perfection, because when we don't move forward, we go back [Womack and Jones, 1996, pp. 16-26].

Figure 2 shows a survey of enterprises. It presents an overview of participants' expectations regarding four technologies to help in handling the five lean principles. Entrepreneurs see the greatest potential in Big Data, this option has been chosen 172 times (multiple answers possible) as a forward-looking tool for supporting the principles. In terms of continuous improvement, participants expect benefits from the possibility of analysing data from various sources.

What potential do the following trends of digitalization provide to support the five Lean principles? n = 73  
 1 = No potential; 2 = Minor potential; 3 = High potential



**Fig. 2.** Potential of trends of digitalization

Source: *Benchmarking – Lean 2020 – The Future of Operational Excellence*, 2018, <http://tectem.ch/content/2-news/20180920-lean2020/report.pdf> 2018, [05.02.2020], p. 25.

Internet of things (158) and Automatization and robotization (147) are at a similar level. Entrepreneurs see their most likely usage with the Flow principle. Both tools would definitely be able to shorten lead times and manage inventories more wisely. Entrepreneurs notice the least potential in Additive Manufacturing.

## 5. Tools and techniques

The methods and techniques introduced should be known and understood. Achieving the set goal depends on this, because Lean tools are directly related to each other. Going further, the main task when using this concept is to properly

group, establish the relationship of tools and apply them in accordance with their function.

5S is a set of techniques and methods aimed at establishing and maintaining high quality place of work. 5S is also one of the basic Lean Management tools, because it is directly related to the proper organization of the work environment, improvement of the company's organizational culture and - which is very important - allows you to increase process stability. The name 5S comes from the first letters of Japanese words, describing five stages:

- *Seiri* (Sort) - removing from the workplace all things that are unnecessary in this moment and leaving what is necessary.
- *Seiton* (Set in order) - equipment marking and placement in designated places where they will be easily accessible.
- *Seiso* (Shine) - regular cleaning and organizing the workplace so that everything assigned to a specific place was always there. An important element is also to eliminate the causes of clutter.
- *Seiketsu* (Standarize) - creating a procedure that will help maintain the standards introduced in the first three points, i.e. sorting, setting in a good place and cleaning.
- *Shitsuke* (Self-discipline) - developing a habit of following previous rules, this can be done by controlling and auditing.

New employees should be taught how to maintain workplace standards as part of the initial training. Good practices are also competitions that are related to the 5S stages, for which employees can get a bonus or at least a distinction in the company forum [Locher, 2012, pp. 14-25].

*FMEA* (Failure Mode and Effect Analysis) - analysis of the causes and effects of possible failure. The method and its variants can be a tool for designers who strive to minimize losses resulting from low quality of a product or service. The analysis is carried out in order to find potential causes of errors made at the design stage and eliminate them at an early stage, before the finished product is created. According to the observations carried out, about 60% of all errors arising during the production of the product or providing the service have their source in the preparatory phase, but at this stage their detectability is low. The basic principles of each FMEA include a set of procedures selected under the project. A typical set of basic principles that was pointed out in Goddard Space Flight Center is as follows [Goddard Space Flight Center, 1996, p. 30]:

- Only one failure mode exists at a time.
- All inputs (including software commands) to the item being analyzed are present and at nominal values.

- All consumables are present in sufficient quantities.
- Nominal power is available.

This process provides a documented method of project selection and an effective method of assessing the impact of proposed changes in project or procedures.

*Kaizen* is otherwise continuous improvement of the organization using the knowledge and commitment of employees. The philosophy comes from Japan and focuses on people who should constantly develop and improve their skills to meet the requirements set by the company. In addition to fulfilling their obligations and complying with standards, employees have the right to submit their ideas and solutions, and implement small improvements (kaizens) in their work that cause the organization to improve faster and gain competitive advantage faster. The kaizen approach assumes that those closest to the work process are best suited to improving these processes [Ulhassan, 2015, pp. 222-228]. In Western culture and in the hierarchical structure of the company, suggesting something to superiors may be perceived as something wrong, otherwise it is the case with Japanese superiors who are open to various types of improvement suggestions. Kaizen is also involving all employees at all levels in order to look for elements of improvement in all areas of the organization. Until now, only a few studies concerned the direct relationship between kaizen results and employees, indicating that kaizen can be linked to employee well-being [Garcia, 2014, pp. 2187-2198]. The lean approach is not about employees putting their ideas into a special box, from which the committee will then choose the best ideas, and the implementation will be done by someone else [Imai, 1986, p. 132]. The submission of suggestions by employees should result from the duties and skills of obtaining manager's information. To permanently introduce the kaizen philosophy into a company, the manager should:

- Encourage people to make suggestions and listen to new ideas - everyone needs help to formulate ideas.
- Find the opportunity to conduct experiments - when ideas are not lacking it comes the problem with testing them. The manager should be able to find time, place and money to check this idea. Such an experiment should take place during the usual work day of the originator.
- Convince the people which are working on the same field that this is a good idea - this is not the easiest thing to do. Convincing everyone involved in the subject that the new idea is worth absorbing is not a simple task, because no one likes to change their habits related to the activity. The manager should encourage and support the group in exchanging views, testing and trying so that the originators can prove their case and receive support.

- Change the standard and make sure that other functions in the organization provide support to the originator - changing the standard is not simple, because the introduced changes often affect other departments in the organization. Among the people who need to be convinced will be at least one who will not like the new changes. The originator at this stage can do nothing, the manager must decide how to deal with the rest of the organization in this situation. [Balle and Balle 2009, p. 78].

*Kanban* - is a technique that was developed by Taiichi Ohno, the same person who was the originator of the concept of Lean Management. In Japanese, the word *kanban* means sign, signboard. It is a special tool for controlling information and regulating material movements between production or service stages. The methodology focuses on minimizing ongoing work and visualizing the transmission of information and products [<https://leankanban.com/project/ten-things/>, 2019]. In traditional production approach, a production schedule is provided for each individual process and each process produces according to that schedule. For Kanban, the schedule synchronizes the processes at the top and bottom of the stream value with each other. The aim of the technique is to reduce inventory in the company and limit its accumulation. When inefficiency is noticed, you set limits on the number of items waiting at supply points, and then reduce them [Schonberger, 2001, pp. 70-71]. When the limit is exceeded, this indicates inefficiency that needs to be eliminated. The introduction of the method reduces the capital needed to maintain inventories and increases production flexibility. Toyota has formulated six principles that will help introduce the Kanban [Taiichi, 1988, p. 176]:

- Only when consumables are used up requests should be sent to yours suppliers.
- Production takes place according to the sequence and number of incoming requests.
- Manufacturing and transporting are only carried out after prior inquiry.
- A request related to an item should be attached to it.
- To ensure that the finished products will be defect-free processes must not send out defective items.
- The process is getting more sensitive and reveals inefficiencies when number of pending request are limited.

Kanban boards are one of the tools that is used to implement Kanban to manage processes and projects in the organization. One of the areas of use is the IT industry. In 2007, David J. Anderson presented the concepts of a new approach that was to help development teams do their work better, faster and at the same

time improve quality. He also developed the five most important kanban properties in IT project management [Anderson, 2010, p. 15]:

- work visualization,
- work-in-progress limitation,
- measurement and flow management,
- creation of a clear process policy,
- use of models to recognize opportunities for improvement.

The kanban methodology does not specify the time that a team of programmers should spend on performing a specific activity, but the number of activities that programmers can do simultaneously. This is an unusual concept, because so far in the agile methods specific activities and time of their implementation was determined at the planning stage.

The organizational context is very important. It is very important to consider the approach of phased implementation of lean. A conscious choice of methods can help build an organizational culture through small winnings and staff involvement. Managers should consider applying methods, assessing the difficulty of its implementation and impact on the organization [Pearce and Pons 2013, p. 16].

## 6. Lean services

The profits resulting from the implementation of Lean in a service company may turn out to be even greater than in a production company. The reason for such results is probably the fact that in production plants, the improvement of productivity, more or less successful, is somewhat inscribed in their activities [Vignesh et al., 2016, p. 2]. On the other hand, service companies usually rarely pay attention to identifying and improving value added, which at the beginning gives some advantage and possibilities.

**Tab. 2.** Types of waste in services

No.	Types of waste in services	Significances
1	Service design waste	No response to customer needs and resulting unnecessary excess features
2	Service item waste	Flaws in service process
3	Service ability waste	Does not make full use of service capacity
4	Service process waste	Low efficiency work
5	Service delay waste	Phenomena that waiters or customers wait

Source: Qu L., Ma M., Zhang G., (2011), *Waste analysis of Lean service*. International Conference on Management and Service Science (MASS 2011), Whuan, China, p. 2.

Li Qu, Man Ma and Guannan Zhang in 2011 published an article in which, based on the stream of lean services value. They pointed out five types of services in which a service enterprise may incur losses. The first is *service design waste*, in which the company does not react or reacts improperly to the needs of customers. In this way, they perform an unnecessary function and incurring unnecessary costs that will not bring a profit anyway. The second type of loss is *service item waste*. Generally, there are defects in the customer service process. This may be incorrect customer service, resulting in the customer not wanting to use our service again. The third type of loss is *service ability waste*, i.e. incomplete use of the capabilities of a given service. The customer would like to get the most for the smallest price, do not want to pay for the stages of the service that he does not see and do not add actual added value to his order. The penultimate type of losses is *service process waste*, i.e. low work efficiency. In the service industry, people have a much greater impact on the final good than in the case of manufacturing companies. That is why it is equally important to pay attention to work efficiency. The last type is *service delay waste*, i.e. the process of waiting for the customer to receive the service and activities related to waiting. They can be shortened, for example, through better cooperation or distribution of work among employees of the enterprise, eliminating stages in which some employees have nothing to do. However, there are some difficulties to working out considerable benefits. First of all, in the service industry the obstacle may be the trouble to notice the work actually carried out, which is often done simply "virtually" [Bhasin, 2015, p. 117]. In addition, they are often complicated and difficult to understand processes. Often in service companies there are also obstacles related to employee resistance to introduced changes.

The adoption of the lean concept in the service sector is quite new. Sceptics say that hospital management is not the same as managing a manufacturing company and you cannot use the same methods. However, data collected over recent years have said that the introduction of lean management in sectors such as health care, IT and public administration can significantly improve work. For the healthcare sector, 40% of all costs do not bring added value. Costs are caused by wasting such things as inventory, time, materials and information. Another issue is unnecessary procedures, wrong medicines, lack of communication, and poor placement of materials and tools. The use of methods such as VSM, Virtual management or Pull system could reduce patient waiting time, reduce the possibility of human error and increase staff productivity [Kadarowa and Demecko 2016, pp. 12-15].

## Conclusions

The literature analysis and my own analysis show that lean management increases the stability of enterprises. It includes tools that help in preventing the occurrence of the crisis, more rarely they are used as tools to fight the crisis, because the concept and tools bring long-term effects. We can achieve positive effects using only selected methods that lean offers us. We do not have to follow all the rules, use all techniques or tools. Matching the right ones to our company is key. Lean management is not limited to tools, but also includes the involvement of an active workforce. Starting from managers who are responsible for choosing the right methods, ideas and people management to ordinary employees, who can share their ideas and have a real impact on the company. The future labor market will force employees to change the sector of operation frequently. The skill of continuous development that is currently the most desirable feature among employees, in the coming years it may even strengthen. Technology in the future may take us work, but less routine activities like medical care require skills not only manual but also emotional. In this matter, it is impossible to replace a man with a machine, but you can standardize his workplace, methods he use or better visualize his workplace. Lean management is not only a concept addressed to entrepreneurs, it is a general change in the way of thinking that can help each unit understand how to easily improve their own and company's operations. Without the commitment of employees, shaping their appropriate attitudes and creating the right conditions for work, the implementation of the Lean concept is difficult. To use the full of the lean management potential, is that to get benefits both economically and satisfactorily, you need to redesign the heart and motivation on the part of the organization. The set of methods, tools and procedures that together create the lean concept is constantly changing and modifying. Big data and internet of things may change perception of lean management. Productivity will increase due to collecting and analysing of manufacture data. Modern enterprises should develop their own solutions, adapting and assimilating classic tools to their needs.

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## **Lean Management – narzędzia, techniki i sposoby wdrażania**

### **Streszczenie**

System gospodarczy, technologia i globalizacja dyktują nowe warunki oraz zasady na rynku. Tradycyjny model zarządzania nie zapewni maksymalnego zysku i nie umożliwi firmom dopasowania się do aktualnych trendów. Narzędzia, techniki i metody powstałe na przestrzeni ostatnich kilkudziesięciu lat oraz poprawne ich wykorzystanie mogą posłużyć do sprawniejszego zarządzania przedsiębiorstwem. Szczupłe zarządzanie skupia się na optymalizacji procesów już istniejących, zapobieganiu wystąpienia nowych problemów, jak również umiejętnym wykorzystaniu zasobów ludzkich. W związku z tym ma ogromne znaczenie w niezwykle konkurencyjnym współczesnym świecie. Przedstawione zostało studium bibliograficzne dotyczące różnych praktyk stosowania lean management wraz z metodami ich wdrożenia. Wnioski płynące z analizy bibliografii dają do zrozumienia, że umiejętności miękkie, sprawna kadra zarządzająca oraz technologie IT mogą być kolejnym etapem rozwoju koncepcji szczupłego zarządzania.

### **Słowa kluczowe**

szczupłe zarządzanie, lean management, produkcja