

Електронний журнал «Ефективна економіка» включено до переліку наукових фахових видань України з питань економіки (Категорія «Б», Наказ Міністерства освіти і науки України № 975 від 11.07.2019). Спеціальності – 051, 071, 072, 073, 075, 076, 292.

Ефективна економіка. 2024. № 1.

DOI: <http://doi.org/10.32702/2307-2105.2024.1.55>

УДК 331.1

M. Shevchenko,

PhD in Economics, Associate Professor,

Associate Professor of the Department of Accounting and Finance,

National Technical University "Kharkiv Polytechnic Institute"

ORCID ID: <https://orcid.org/0000-0003-2165-9907>

T. Kulinich,

PhD in Economics, Associate Professor of the Department of

Management of Organizations, Lviv Polytechnic National University

ORCID ID: <https://orcid.org/0000-0003-0110-7080>

N. Rogova,

PhD in Technical Sciences, Associate Professor,

Poltava University of Economics and Trade

ORCID ID: <https://orcid.org/0000-0002-5189-9058>

PRINCIPLES OF LEAN MANAGEMENT AND THEIR IMPACT ON THE EFFICIENCY OF PRODUCTION PROCESSES

М. М. Шевченко,

к. е. н., доцент, доцент кафедри обліку і фінансів,

Національний технічний університет "Харківський політехнічний інститут"

Т. В. Кулініч,

к. е. н., доцент кафедри менеджменту організацій,

Національний університет "Львівська політехніка"

Н. В. Рогова,

к. т. н., доцент,

доцент кафедри готельно-ресторанної та курортної справи,

Полтавський університет економіки і торгівлі

ПРИНЦИПИ LEAN-МЕНЕДЖМЕНТУ ТА ЇХ ВПЛИВ НА ЕФЕКТИВНІСТЬ ВИРОБНИЧИХ ПРОЦЕСІВ

Currently, the application of Lean management or its elements is widespread. The evolution of this management technology has shaped its principles, which are effective in improving the efficiency of interconnected work and natural processes, resulting in the transformation of raw materials and resources into high-quality and competitive finished products for economic entities. By the outlined significance of Lean management and its associated scientific issues, the article aims to study the principles of Lean management and their impact on the efficiency of production processes. The research results demonstrate that the overall impact of Lean management principles on the efficiency of production processes for economic entities is only realized when based on fundamental concepts such as: eliminating unnecessary operations that do not add value to the final product or service, reducing excess production inventory, balancing workload on equipment and employees, determining temporal time (i.e., the time to produce one unit of product), adopting systemic thinking, involving employees at all levels in the improvement process, and recognizing their experience and initiative. It is observed that only the effective implementation of Lean management principles leads to positive changes in production systems, such as cost minimization, process optimization, improvement in product quality, and employee engagement. It has been demonstrated that the content and systemic nature of each principle contributes to a multi-level impact of Lean management on the efficiency of production processes. The multi-level nature manifests itself simultaneously in several dimensions, particularly in: increasing production productivity (achieved through cost minimization, optimization of production processes, and increased production capacity), reducing levels of production and other inventories (achieved through reducing excess inventories, decreasing costs of storage, and avoiding production delays), improving product quality (achieved through eliminating unnecessary operations, controlling deviations, and reducing costs associated with error correction), and engaging employees in the process of improving production processes (achieved through identifying and implementing effective ideas for process improvement).

На сьогоднішній день застосування Lean-менеджменту або його окремих елементів є повсюдним. Еволюція цієї управлінської технології сформувала такі її принципи, які є дієвими у підвищенні ефективності взаємозв'язаних процесів праці і природних процесів, в результаті яких вихідні матеріали і сировина перетворюються на якісну і конкурентоспроможну готову продукцію суб'єктів економічної діяльності. Відповідно до визначеної значущості Lean-менеджменту та властивості йому наукової проблематики, метою статті є вивчення принципів Lean-менеджменту та їх впливу на ефективність виробничих процесів. За результатами дослідження доведено, що в цілому вплив принципів Lean-менеджменту на ефективність виробничих процесів суб'єктів економічної діяльності формується лише у випадку їх базування на таких положеннях, як усунення зайвих операцій (або таких, які не додають вартості кінцевому продукту чи послугі), усунення надмірних виробничих запасів, усунення нерівномірності навантаження на обладнання та працівників, визначення тактового часу (тобто часу на виробництво одиниці продукції), системне мислення. Констатовано, що лише ефективне впровадження принципів Lean-менеджменту призводить до позитивних змін у виробничих системах (таких як мінімізація витрат, оптимізація, покращення якості продукції тощо). Доведено, що зміст та системний характер кожного принципу формує багаторівневий вплив Lean-менеджменту на ефективність виробничих процесів. Зміст багаторівневості проявляє себе одночасно в кількох аспектах, зокрема у: підвищенні продуктивності виробництва (що досягається коштом мінімізації витрат, оптимізації виробничих процесів та збільшення виробничої потужності), зменшенні рівня виробничих та інших запасів (що досягається коштом зниження надмірних запасів, зменшення витрат на їх зберігання та уникнення затримок у виробництві), покращенні якості продукції (що досягається коштом усунення непотрібних операцій, стримування відхилень та зменшення витрат на виправлення помилок), залученні працівників до процесу вдосконалення виробничих процесів (що досягається коштом виявлення та реалізації дієвих ідей для поліпшення виробничих процесів).

Keywords: *cost reduction; excess inventory; underutilization of production system; production of one unit; management.*

Ключові слова: *зменшення витрат; надмірні запаси; недовантаження виробничої системи; виробництво одиниці продукції; менеджмент.*

Target setting. Lean management emerged as a management technology in the production system of Toyota in Japan. The founders of the Lean approach are Taiichi Ohno and Eiji Toyoda, who began developing this system in the mid-20th century. The primary work on the Lean approach was carried out from 1950 to 1960, focusing on eliminating unproductive costs and optimizing production processes [6]. Later, from 1960 to 1970, the approach expanded beyond the automotive industry in Japan. After the Second World War, when the country began massive economic transformations, Lean management began to be actively applied in other sectors, such as electronics and manufacturing. In particular, the Oxford Group in Japan actively researched the Toyota production system from 1980 to 1990. As a result, the Lean management approach gained global prominence in the 1990s, as many international companies began adopting it to enhance efficiency and competitiveness [6]. Today, the application of Lean management or its elements is widespread [6]. The evolution of this approach has formulated principles effective in enhancing the efficiency of interconnected work processes and natural processes. As a result, raw materials and inputs are transformed into high-quality, competitive finished products for economic entities across various production sectors.

Analysis of research and publications. There is currently a significant body of work dedicated to Lean management and the study of the peculiarities of using its tools in crisis conditions. Notably, among the recent works, contributions by Bek O.M., Petetskyi I., Bylovs-Serhiieva S.O., Denysiuk O.H., and Sannikova S.B. have been highlighted by us. Moreover, most of the mentioned researchers also emphasize the uniqueness of Lean management principles, resulting in their positive impact on the efficiency of production processes. However, there is a lack of systematic research in this direction. Thus, the systematic identification and characterization of Lean management principles and their impact on the efficiency of production processes are

currently the most relevant issues. The obtained results have the potential to provide a specific framework for optimizing production processes and achieving maximum efficiency.

The wording of the purposes of article (problem). By the outlined significance of Lean management and its associated scientific issues, the purpose of the article is to study the principles of Lean management and their impact on the efficiency of production processes.

The paper main body with full reasoning of academic results. In management practice as of 2023, Lean management has gained significant prevalence. According to data from PricewaterhouseCoopers, out of 100 surveyed economic entities, only 20% fully implemented the complete version of Lean management as a comprehensive management technology [6]. However, individual elements of Lean management were already utilized by 45% of the surveyed entities (all of whom expressed an intention to transition to the full version of Lean management over time) [6]. In our opinion, such widespread adoption of Lean management is driven by its significant impact on the efficiency of production processes.

So, according to the available scientific literature [3; 8], the specificity of the impact is shaped by the fundamental principles of Lean management. These principles, as indicated by the studies of Bruce, M., Daly, L., Towers, N. [3], are used to align planning, coordination, organization, and control processes by the core idea of Lean or its inherent general rules (which serve as the foundation for the development of production systems for economic entities). These principles include [1-2; 5; 8]:

1. Elimination of unnecessary operations (Muda) that do not add value to the final product or service. This principle involves eliminating non-value-added motions that result in prolonged waiting times for orders, processing, and other types of waste.
2. Elimination of excessive production inventory (Mura). Specifically, the necessary level of inventory should be maintained to support continuous production, avoiding the formation of excessive stocks that could lead to value losses.
3. Elimination of unevenness (Muri). It is envisioned that ensuring a uniform distribution of workload on equipment and employees should be achieved (to the extent that it avoids overloading or underloading).

4. Defining Temporal Time, which is the time needed to produce one unit of product to meet market demand. Determining Temporal Time helps manage production to avoid overloading or underloading the production system.
5. Thinking System involves considering the production process as a holistic system (to the extent that it allows for consideration of relationships and interdependencies between its elements).
6. Inclusion of employees (Respect for People). Specifically, ensuring the involvement of employees at all levels in the improvement process, recognizing their experience and initiative.

These principles enable economic entities to achieve greater flexibility, adaptability, and competitiveness in a volatile business environment [5; 8]. However, the systematic application of these principles is crucial, as it dictates adherence to the core ideas and general rules that serve as the foundation for the development of Lean management, as well as the functionality of its systems or methods (Figure 1).

Specifically, according to the Muda principle, the key idea is the necessity for the economic entity to identify and eliminate all operations that do not add value to the final product or service. For the development of Lean management, it is crucial to identify all operations within the economic entity that are considered 'unnecessary' including:

1. Unnecessary motions (such as unnecessary movements of workers or materials without necessity [2]).
2. Prolonged waiting (including time delays when workers or equipment wait for the next operation or event [7-8]).
3. Over-processing (identifying partially beneficial operations that require additional effort without actual improvement to the product [8]).
4. Overproduction (referring to the production of goods that are not needed now).
5. Excess inventory (identifying excessively accumulated materials or products that can lead to storage costs and other issues [1-2]).

By the above, one of the principles of Lean management is the optimization of processes, achieved by focusing on the most critical elements (or those that bring real

value to both the customer and the producer [5]). This principle helps reduce costs, increase productivity, and improve the quality of products or services.

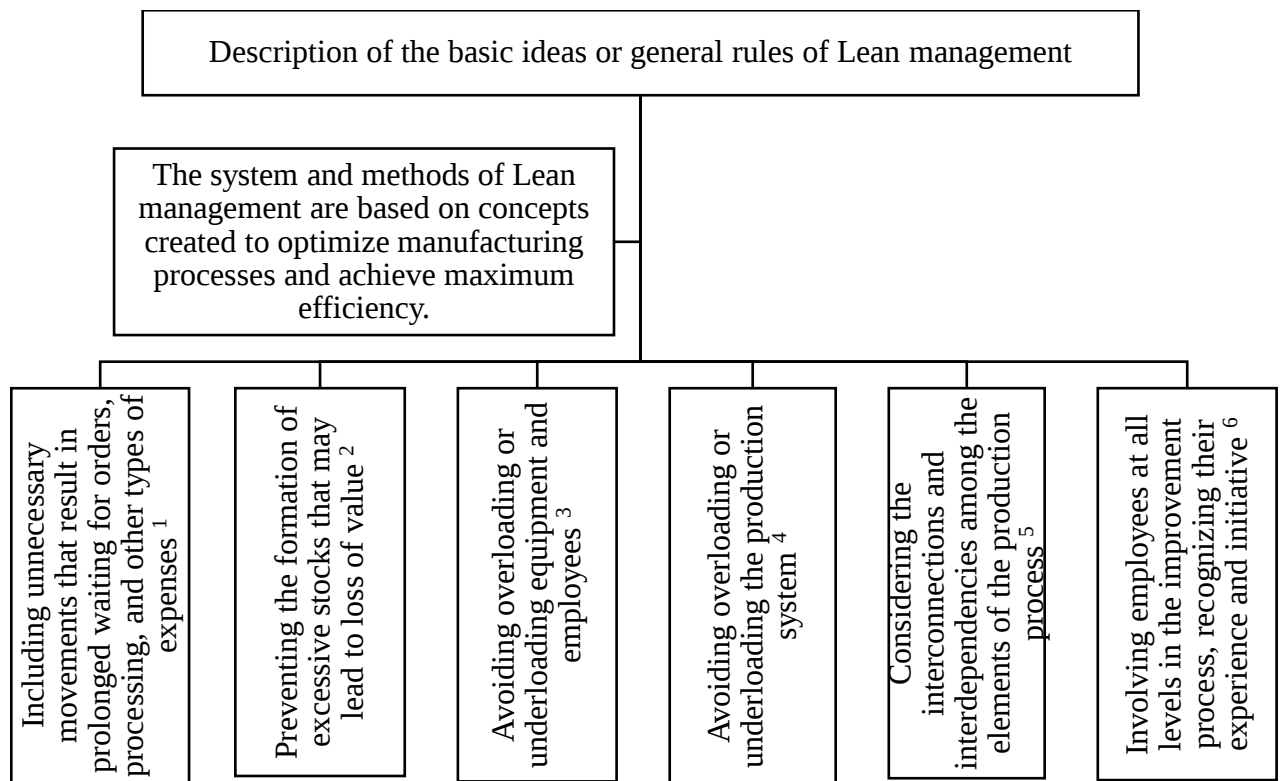


Figure 1. Key ideas or general principles that serve as the foundation for the development of Lean management.

Note:

- 1 Forms the Lean management development principle of process optimization by focusing on the most critical elements (or those that bring real value to both the customer and the producer).
- 2 Forms the Lean management development principle of avoiding value losses due to outdated goods, spoilage, or other factors related to maintaining excessive inventory.
- 3 Forms the Lean management development principle of ensuring the stability and efficiency of production processes by minimizing the risks of overloading or underloading, improving work quality, and increasing overall productivity.
- 4 Forms the Lean management development principle of maximum harmonization of production operations.
- 5 Forms the Lean management development principle of avoiding local optimization and promoting the identification of common opportunities for improvement.
- 6 Forms the Lean management development principle of transforming employees into key participants in the process of achieving efficiency and quality.

Source: formed based on [1-2; 8].

According to the Mura principle, the key idea is the need for the economic entity to achieve the most optimal level of inventory. For the development of Lean management, it is essential to support continuous production through the following operations [1; 8]:

- 1 Ensuring only the necessary volume of materials or finished products to support production needs.
- 2 Preventing the accumulation of inventory that could lead to obsolescence, spoilage, increased storage costs, and so on.
- 3 Ensuring the availability of necessary materials or components precisely when they are needed for production, without forming excessive inventory.
- 4 Planning and production oriented towards real market needs to avoid irregularities in demands.

By the above, one of the development principles of Lean management is to avoid the loss of value due to the obsolescence of goods, their spoilage, or other factors related to maintaining excessive inventory.

In accordance with the Muri principle, the main idea is the need for an even distribution of workload on equipment and employees. For the development of Lean management, it is essential to avoid overloading or underloading equipment and employees by implementing the following operations [2; 4; 8]:

1. Distributing tasks and functions among employees and equipment in such a way as to avoid overloading or underloading specific operations in the production process.
2. Ensuring the stability and predictability of equipment production characteristics to avoid significant fluctuations in its workload and the workload of operator employees.
3. Organizing work schedules in a way that evenly distributes the workload and avoids steep fluctuations in demand (including the possible use of flexible work schedules that can adapt to changes in workload and utilize periods of lower demand for maintenance, employee training, or other activities).

Under the above, one of the rules for the development of Lean management is ensuring the stability and efficiency of production processes by minimizing the risks of overloading or underloading, improving work quality, and increasing overall productivity.

Following the Temporal Time principle, the main idea is the need for the economic entity to achieve efficiency in current production processes. Specifically, for

the development of Lean management, it is crucial to enhance the productivity of these processes through operations:

1. Defining a Temporal Time allows for establishing a production rhythm and distributing production evenly.
2. Aligning the production process to avoid overloading or underloading workstations or operator employees.
3. Establishing standards for production. This should be done considering the Temporal Time as the production standard, and the entire process is organized based on this standard (necessary for achieving a harmonious resource distribution).
4. Maximizing production capacity by managing production processes according to Temporal Time and focusing on the optimal utilization of production resources.

One of the rules for the development of Lean management is the maximization of harmonization of production operations, characterized by features such as alignment of production results with market needs, absence of non-productive waste, and efficiency of the entire production system.

Following the Temporal Time principle, the main idea is the need for the economic entity to view the production process as a holistic system. For the development of Lean management, it is essential to pay maximum attention to the relationships and interdependencies between various elements of such a process system, which can be achieved through the following operations:

1. Defining the separate and overall logic of interaction between different elements of the production process.
2. Formulating a detailed algorithm of the influence of each element of the process system on the efficiency and outcomes of other system elements.
3. Developing the ability to identify and consider feedback in the system, considering how the performance of processes can be adjusted or influence the production system itself.

One of the rules of Lean management development is to avoid local optimization and promote the identification of common opportunities for improvement (through

understanding and optimizing production processes in their entirety rather than individually [4]).

By the Respect for People principle, the main idea is the need for the economic entity to involve employees at all levels of the organization in the improvement of production processes and to value their experience and initiative.

Specifically, for the development of Lean management, it is crucial to pay maximum attention to creating a responsible and effective work environment through the following operations [4; 5; 8]:

1. Ensuring employee participation in decision-making processes related to production, problem identification, and finding optimal solutions.
2. Fostering an appreciation for the experience and knowledge of employees as a valuable resource suitable for improving production processes.
3. Creating a work environment where employees can express their ideas, initiate improvements, and contribute to their implementation.
4. Providing opportunities for skill development and training for employees by supporting their professional growth.
5. Establishing trust between management and employees, as well as active communication to exchange information and ideas.

By the above, one of the principles of Lean management is transforming employees into key participants in the process of achieving efficiency and quality.

It should be noted that the impact of Lean management on the efficiency of production processes is expressed in a variety of positive outcomes in overall business performance, as highlighted in the figure 2.

So, noted that the impact of Lean Management on the efficiency of the economic entity's production processes is multi-faceted, as it manifests itself simultaneously on several levels, including:

1. Increased production productivity. This contributes to: 1) cost minimization (by identifying and eliminating any actions or processes that do not add value to the product [3]); 2) optimization of production processes (by efficiently using labor, equipment, and other resources [8]); 2) increased production capacity (by eliminating waste and

optimizing processes, adapting production lines and processes to changes in demand or production conditions [8]).

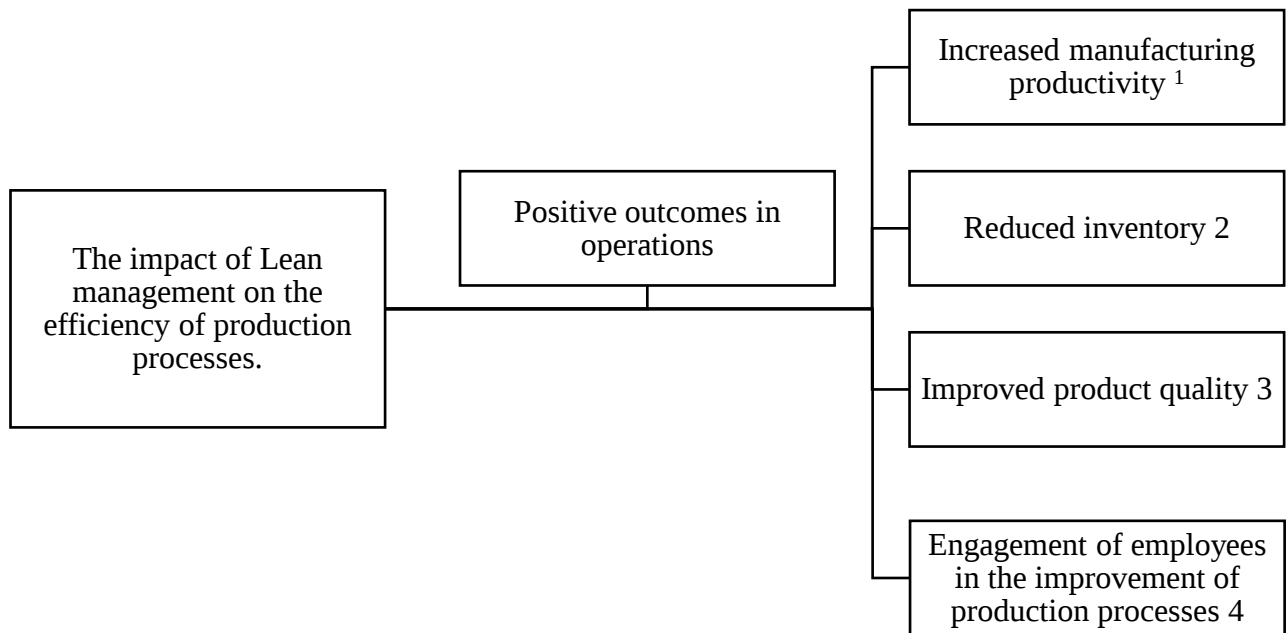


Figure 2. Impact of Lean management on the efficiency of the economic entity's production processes

Note:

1. The first result contributes to: 1) cost minimization; 2) optimization of production processes; 2) increased production capacity.
2. The second result contributes to: 1) reduction of excess inventory; 2) decrease in costs associated with storing inventory; 3) avoidance of delays in production.
3. The third result contributes to: 1) elimination of unnecessary operations (by identifying and correcting issues negatively impacting product quality); 2) prevention of deviations; 3) reduction in costs for error correction.
4. The fourth result contributes to: 1) the identification of effective ideas; 2) the implementation of effective ideas to improve production processes.

Source: formed based on [2; 3-5].

2. Reducing the levels of production and other inventories. This contributes to: 1) reducing excess inventory (by making it possible to produce and supply products, goods, or components at the moment they are needed for production [2]); 2) reducing storage costs for inventory (by efficiently using warehouse space and minimizing risks associated with spoilage, obsolescence, or loss of goods [3]); 3) avoiding production delays (by managing inventory levels at each stage of production, achieving high production flexibility, and synchronizing production processes [3]).

3. Improving product quality. This contributes to: 1) eliminating unnecessary operations (by identifying and correcting issues negatively affecting product quality [1]); 2) preventing deviations (by stabilizing production processes, reducing variability, and mitigating the impact of random factors that may lead to quality deviations [7]); 3) reducing costs associated with error correction (by minimizing the number of defects and errors in production [3]).

4. Involving employees in the process of improving production processes. It leads to: 1) identifying effective ideas (by engaging diverse teams and individual perspectives [8]); 2) implementing effective ideas to enhance production processes (particularly welcoming employee initiatives that can lead to the successful implementation of improvements and process optimization [8]).

Conclusions from this study and prospects for further exploration in this area. Based on the research results, it has been demonstrated that Lean management has gained significant prevalence, thanks to its ability to have a substantial impact on the efficiency of production processes in economic entities. Following the identification and systematic characterization of these principles, the following conclusions have been drawn:

1. Overall, the impact of Lean management principles on the efficiency of production processes in economic entities is realized only when they are based on fundamental concepts such as: eliminating unnecessary operations that do not add value to the end product or service, eliminating excess production inventory, addressing uneven workload on equipment and employees, determining temporal time, i.e., the time to produce one unit of product, and adopting systemic thinking (including employees at all levels in the improvement process, recognizing their experience and initiative). Effective implementation of Lean management principles leads to positive changes in production systems, such as cost minimization, process optimization, improved product quality, and employee engagement.
2. The content and systemic nature of each Lean management principle contributes to a multi-level impact on the efficiency of production processes. The multi-level aspect manifests simultaneously in various dimensions, including the

enhancement of production productivity (achieved through cost minimization, process optimization, and increased production capacity), reduction of production and other inventories (achieved through the decrease of excess inventories, lower storage costs, and avoidance of production delays), improvement in product quality (achieved through the elimination of unnecessary operations, control of deviations, and reduction in error correction costs), and the engagement of employees in the improvement of production processes (achieved through the identification and implementation of effective ideas).

By the above, there is a need for further research on specific implementations of Lean management in various industries and contexts and also an assessment of its impact on specific economic indicators.

Література

1. Бек О.М., Петецький І. Lean-менеджмент як інноваційний підхід до управління виробництвом. *Вісник Національного університету «Львівська політехніка». Логістика*. 2017. Вип. 863. С. 12-16.
2. Білоус-Сергєєва С.О. Роль управління якістю у концепції «Lean production» та проблеми її впровадження на вітчизняних виробництвах. *Reporter of the Priazovskyi state technical university*. 2018. Вип. 35. С. 77-83.
3. Bruce M., Daly L., Towers N. Lean or agile: A solution for supply chain management in the textiles and clothing industry? *International Journal of Operations and Production Management*, 2004. Vol. 24(1-2). P. 151–170.
4. Денисюк О., Саннікова С. Lean-менеджмент як технологія управління вітчизняними підприємствами в умовах кризи. *Економіка та суспільство*, 2022, Вип. 46. URL.: <https://economyandsociety.in.ua/index.php/journal/article/view/2023/1952> (дата звернення: 22.08.2023).
5. Karyu, O., Knjazevska, O. Tasks prioritization of strategic planning of cities development: Experts' approach. *Economics and Sociology*. 2009. Vol. 2(1). P. 58-66.

6. PricewaterhouseCoopers database (2023) PwC report “SMART management models”. URL: https://www.pwc.com/content/pwc/userReg/login.en_gx.html?redirectUrl=gG0V-55Ilpsw21J2UMYgbIH5kctJLK2-lwWPau2GN84=&referrer=gG0V-55Ilpsw21J2UMYgbIH5kctJLK2-lwWPau2GN84=&parentPagePath=/content/pwc/gx/en.
7. Tomchuk O., Tserklevych V., Hurman O., Petrenko V., Chymosh K. The efficiency of higher education institutions: evaluation and management of managers. *Estudios De Economia Aplicada*. 2021. Vol. 38(4). P. 40-46.
8. Veres C. Conceptual Model for Introducing Lean Management Instruments. *Procedia Manufacturing*. 2020. Vol. 46. P. 233–237.

References

1. Bek, O.M. and Petets'kyi, I. (2017), “Lean management as an innovative approach to production management”, *Visnyk Natsional'noho universytetu «L'vivs'ka politekhnika»*. *Lohistyka*, vol. 863, pp. 12-16.
2. Bilous-Serhyeyeva, S.O. (2018), “The role of quality management in the concept of "Lean production" and the problems of its implementation at domestic productions”, *Reporter of the Priazovskyi state technical university*, vol. 35, pp. 77-83.
3. Bruce, M., Daly, L. and Towers, N. (2004), Lean or agile: A solution for supply chain management in the textiles and clothing industry? *International Journal of Operations and Production Management*, vol. 24(1-2), pp. 151–170.
4. Denysyuk, O. and Sannikova, S. (2022), “Lean management as a management technology of domestic enterprises in crisis conditions”, *Ekonomika ta suspil'stvo*, vol. 46, available at: <https://economyandsociety.in.ua/index.php/journal/article/view/2023/1952> (Accessed 22.08.2023).
5. Karyy, O. and Knjazevska, O. (2009), “Tasks prioritization of strategic planning of cities development: Experts' approach”, *Economics and Sociology*, vol. 2(1), pp. 58-66.

6. PricewaterhouseCoopers database (2023) PwC report “SMART management models”, available at:
https://www.pwc.com/content/pwc/userReg/login.en_gx.html?redirectUrl=gG0V-55Ilpsw21J2UMYgbIH5kctJLK2-lwWPau2GN84=&referrer=gG0V-55Ilpsw21J2UMYgbIH5kctJLK2lwWPau2GN84=&parentPagePath=/content/pwc/gx/en (Accessed 05 Jan 2024).
7. Tomchuk, O., Tserklevych, V., Hurman, O., Petrenko, V. and Chymosh, K. (2021), “The efficiency of higher education institutions: evaluation and management of managers”, *Estudios De Economia Aplicada*, vol. 38(4), pp. 40-46
8. Veres, C. (2020), “Conceptual Model for Introducing Lean Management Instruments”, *Procedia Manufacturing*, vol. 46, pp. 233–237.

Стаття надійшла до редакції 13.01.2024 р.