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SYSTEMATIZATION OF APPROACHES TO THE UNDERSTANDING AND IMPLEMENTATION OF LEAN MANUFACTURING

СИСТЕМАТИЗАЦІЯ ПІДХОДІВ ДО РОЗУМІННЯ ТА ВПРОВАДЖЕННЯ ОЩАДЛИВОГО ВИРОБНИЦТВА

The work systematizes approaches to understanding the essence of lean production and takes into account the specifics of implementing this concept specifically for Ukrainian enterprises. The toolkit of lean production, which can be implemented in Ukrainian enterprises, has been systematized. For each type of tool, it is indicated which tasks it can solve for Ukrainian enterprises and what is the peculiarity of its application for domestic economic entities. Most of the companies that are already implementing or have implemented a lean production system have carried out preliminary measures to prepare personnel for the implementation of these latest tools, and for Ukrainian enterprises, this preparatory stage is just as necessary because there is an urgent need to understand that enterprises will be able not only to implement the tools of lean production but also to implement qualitative transformations in the management system of the enterprise. It has been proven that the problem at Ukrainian enterprises is mostly outdated equipment and significant dependence of production processes on personnel, as a result, for the effective implementation of lean production approaches, it is necessary to train personnel and improve their qualifications. Outdated equipment should be updated and new resource-saving technologies introduced, but this is a longer and more expensive way than training staff. A diagram of the relationship between the possibilities of lean production implementation and staff training for obtaining quality transformations at domestic enterprises has been developed, which indicates the importance of staff training to achieve positive results from the implementation of the concept of lean production. This scheme allows you to clearly follow the sequence of stages of staff training to ensure readiness for the implementation of the lean production system and to prepare staff for quality transformations in enterprise management. It has been proven that the staff is the main link of transformations at the enterprise and ensuring its better management and timely implementation of measures to save resources.

Keywords: lean production, tools of lean production, costs, resources, personnel, personnel training, management, management system.

В роботі проведено систематизацію підходів, до розуміння сутності ощадливого виробництва та враховано особливості імплементації цієї концепції саме для українських підприємств. Встановлено, що українські підприємства сьогодні потребують новітніх інструментів для економії ресурсів, зокрема, енергоресурсів, оскільки через воєнні дії в державі є потреба ощадливого використання всіх видів ресурсів. Обґрунтовано, що реалізовувати потенціал економії ресурсів можливо з використанням інструментів ощадливого виробництва, які позитивно показали себе в багатьох країнах і використовуються успішними міжнародними компаніями. Систематизовано інструментарій ощадливого виробництва, який може бути впроваджений на українських підприємствах. Систематизацію проведено на основі вивчення досвіду провідних світових компаній, конкретизовано можливість застосування кожного із запропонованих інструментів для вирішення певних задач розвитку українського бізнесу. Доведено, що на українських підприємствах здебільшого проблема полягає у застарілому обладнанні та значній залежності виробничих процесів від персоналу, як результат, для ефективного впровадження підходів ощадливого виробництва необхідно здійснювати навчання персоналу та підвищення його кваліфікації. Розроблено схему взаємозв'язку можливостей імплементації ощадливого виробництва та навчання персоналу для отримання якісних перетворень на вітчизняних підприємствах, яка вказує на важливість навчання персоналу для досягнення позитивних результатів від впровадження концепції ощадливого виробництва. Встановлено, що можливі витрати на навчання персоналу в короткостроковому періоді досить швидко перекриваються позитивним ефектом від реалізації концепції ощадливого виробництва. До того ж, розвиток персоналу завжди позитивно впливає на потенціал розвитку підприємства та створює передумови для формування корпоративної культури, яку також можна розглядати, як напрям розвитку підприємства. Також підсумовано, що українські підприємства потребують впровадження сучасного ощад-

ливого виробництва через низку недоліків наявних нині, але і наголошено, що одним з основних чинників відтермінування впровадження ощадливого виробництва є саме людський фактор – недосвідченість персоналу щодо можливих аспектів таких перетворень.

Ключові слова: *ощадливе виробництво, інструментарій ощадливого виробництва, витрати, ресурси, персонал, навчання персоналу, управління, система управління.*

Problem statement. Modern management systems are constantly being improved under the influence of the external environment, and approaches to management are subject to current trends in the development of the global economy. One of these trends today is the desire of business owners and managers to save resources. In this case, we are talking not only about material resources but also about different types of resources in the broadest sense. In the aspect of resource-saving, one of the most modern and comprehensive is the approach of economical production, which is aimed at the rational use of various types of resources, and intensive business development without loss of product quality. Therefore, the systematization of approaches to the introduction of lean production will allow the enterprise to find for itself its optimal tools and to apply in practice, taking into account the specifics of the production sphere or industry.

Analysis of recent research and publications. To analyze the prospects for introducing the concept of lean production in the activities of Ukrainian enterprises in the work worked out the scientific groundwork of both domestic and foreign experts. Among foreign scientists, it is necessary to allocate separately Batin N. and J. Drew [10] considering features of the concepts of lean production [11], considering the features of the concepts of lean production.

In recent years Ukrainian scientists also pay enough attention to the problem of implementation of the concept of lean production. For example, in the work of Ryzhenko O. [7] details the peculiarities of the introduction of lean production at industrial enterprises, and Shvets F. D., Pakharenko O. V. та Andriitso-Ruzaieva A. Yu. [9] detail the methodological toolkit of lean production for the real sector of the economy Also noteworthy is the work of Sych D. M. [7], where lean production is considered from the position of prospective changes in the financial condition of the enterprise.

Thus, we see that the topic of the introduction of lean production is relevant to modern economic literature, but a single approach to the optimal implementation of the lean production system at Ukrainian enterprises has not yet been formed.

The purpose of the article is to theoretically generalize and systematize approaches to understanding the essence of lean manufacturing, as

well as to develop practical recommendations for its implementation.

Presentation of the main material. Historically, the emergence of the lean production approach was accompanied by the construction of a system of tools for its development. For the first time, the idea of lean production emerged at the Japanese company Toyota in the 1950s and implied the maximum rationalization of all types of costs. It should be noted that the orientation was not to minimize costs, but precisely on their optimization, that is, the most efficient use of all resources used in the production process. Besides, the idea of lean production was focused on transformation absolutely at all levels of management and should concern not only managers but also employees [9].

The strategic goal of the concept of lean production is to ensure the maximum efficiency of the use of all types of resources and minimize the cost of the formation of these resources, involving changes at each stage of the implementation of important business processes [12].

The tactical objectives of the lean manufacturing concept are:

- focus on reducing material costs;
- minimization of the use of physical labor;
- reduction of the period of development of finished products: from idea to introduction into mass production;
- reduction of the production cycle of product manufacturing;
- reduction of the volume of stocks stored in warehouses and warehouse space in general;
- achieving maximum product quality at minimum cost.

As indicated, the concept of lean manufacturing dates back to the 1950s and has undergone quite a few transformations so far, with new tools, ideas, opportunities, and application experience.

Applying Toyota's experience and considering the current state of affairs with the lean manufacturing concept, consider the ideas of Tahiti Ono, a Toyota engineer who later became chairman of the board of directors. He developed his production system and distinguished in it 7 types of losses, which can be divided into the following groups [3]:

- over-creation-when a company produces more products than it can sell. Taita Ono considered it the main type of loss that caused others to arise;
- large inventories, surplus. In a modern interpretation, it is unrealized projects, as well as

unused materials and resources. For example, unpublished texts, unused code, or unapproved image layout. Because funds have been committed to these projects, but they are not finished and have not begun to generate cash flow for the company;

- unnecessary functionality – options and features that are in the product or service, but are not used by end-users;

- Wait and Delay – all those moments where the team has to wait for others to make a decision to proceed. For example, you have to wait for the design department to decide or get approval from the finance department to proceed with the project;

- defects and shortcomings – it takes resources and time to fix them, so it is better to monitor the quality of work from the initial stages. In general, it is easier in the enterprise to minimize defects and not lose customers due to poor quality;

- re-examination or unnecessary processing steps – can occur when one function is performed by different specialists and different departments. If the work is performed by a team, a clear division of roles in the team is necessary;

- irrational movement – both unnecessary transportation and constant switching between tasks are implied. Examples are when materials are not delivered between departments promptly, when an employee performs several different projects at the same time, resulting in a decrease in the quality of the functions performed.

In recent years, when information, time, and human capital have become the most valuable, the listed costs can include the unrealized creative potential of the enterprise's employees, due to which the enterprise has not found an opportunity to create the most favorable conditions for the development of each individual employee.

In general, it can be said that lean production is aimed at reducing all these types of costs with simultaneous rational use of resources. Over the course of the evolution of the lean production

approach, however, it has grown into a much larger and more systematic concept than just a cost-reduction approach. Therefore, it is advisable to further systematize the existing tools of lean production and determine the possibilities of their application for Ukrainian enterprises – Table 1.

For Ukrainian enterprises, the introduction of the concept of lean production can begin with the formation of prerequisites for the integration of individual tools, and then a comprehensive system of lean production. Having analyzed the scientific literature [4; 7; 9] on the analyzed issues, it becomes possible to assert that for Ukrainian enterprises there are two main prerequisites for the introduction of the concept of lean production, namely:

- obsolete equipment that does not allow efficient use of resources, including material resources;

- significant influence of the human factor on the performance of the production process.

In addition, the work [2] focuses on the fact that in the conditions of remote work the specialists of many enterprises especially need to improve their skills, which will allow them to work more effectively and use intellectual resources.

The strategy of economical production compared to the modernization of equipment, or the launch of new products is a cheaper way to improve the enterprise. However, the correctness of its application depends on the skills of the manager. In other words, when a company intends to implement a lean production strategy, it is necessary to find a qualified specialist. In Ukraine, unfortunately, there are very few people able to interpret the Japanese methods competently. Besides top management and managers, it is necessary to familiarize workers with them. This is the cost of implementation because it implies a training the personnel and raising their qualifications. It is assumed that some workers and managers may not accept the changes because they are used

Table 1

Characteristics of the main tools for implementing the lean manufacturing approach and the possibility of its application for Ukrainian enterprises

Tool	Feature	Possibilities of application for Ukrainian enterprises
TPM system	general care of equipment. It is a system of maintaining and improving the integrity of production systems, safety, and quality with the help of machines, equipment, processes, and employees that organize and increase the value of the business	Ukrainian manufacturing enterprises are mostly characterized by the significant depreciation of production equipment, as a result, there is an objective need for constant monitoring of equipment, quality of processes carried out on it, etc.
Map of the value stream	a tool that visualizes the process of transforming raw materials into finished products sold to consumers and allows you to understand at which stage the most resources are used	the tool is useful for any enterprise, as it allows you to determine at what stage the value of the product is formed

(End of Table 1)

Tool	Feature	Possibilities of application for Ukrainian enterprises
5S system	a tool for the rational organization of the workspace of each employee, according to which each workplace must meet all five requirements: cleanliness, order, accuracy, strict adherence to all standards, and compliance with labor discipline	it is especially relevant to apply this tool for mental labor specialists, as their productivity often depends on compliance with 5S requirements to their own workplace. Undoubtedly, it can and should be applied to Ukrainian enterprises and Ukrainian business
Kanban	a visual tool that allows you to monitor the timing of projects or production process. Allows to ensure maximum transparency and openness of processes accompanying the production of products or implementation of various projects at the enterprise	is an extremely important tool that allows you to monitor compliance with the sequence of stages of a project. The tool is especially relevant today for the IT sphere, where modern management tools are already quite actively used
Kaizen Method	a set of various tools, a concept that focuses on the continuous improvement of production processes and the enterprise management system	Ukrainian enterprises are constantly developing in conditions of resource-saving, and with the outbreak of a full-scale war, these trends are even more intensified, so the use of the Kaizen method is especially appropriate for Ukrainian enterprises
The system “just in time”	a supply policy that requires materials, goods, and services to be delivered at the exact time they are needed for a job or process. Used to reduce inventory, waiting time, and spoilage	can be used at enterprises where the system of “smart management” or “lean production” is already implemented, as it provides for the availability of a basis in the form of analytical procedures for identifying weaknesses in the development of production
System “flow of similar products”	a tool that provides for the elimination of multitasking, which reduces the likelihood of defects, loss of attention by employees, irrational use of material resources	rationally used at those enterprises where a production involves a sequence of similar operations and there is a need to monitor the probability of defects
Poka-yoke system	mainly a technical or informational tool to protect machinery, employees, and finished products from errors or defects (“foolproofing”). It provides for the protection of machinery, tools, products, and people at different stages of the process from obviously incorrect or dangerous human actions in interaction with these items	allows to minimize the negative interference of employees in the operation of equipment and allows to systematize of different approaches to protect equipment from unqualified interference. Extremely effective in large production enterprises
SMED system	a system that allows for quick reconfiguration of production equipment and accelerates the production process and sales of products, resulting in savings of material and financial resources, as well as less time spent on the production process	advisable for use at those enterprises where the production process has reserves for reducing the use of resources or optimizing the production process
The technique of visualization of operational management	involves the use of various tools for graphic representation of the production process and enterprise management system, indicating the main advantages and disadvantages of each production process	often to start work on the implementation of the lean production system, the enterprise should form a general idea of the state of technical capabilities of the enterprise and its potential for further development, technical visualization can help in this
“Spaghetti” chart tool	a graphical tool for displaying elements of the production process and understanding the involvement of specialists, equipment, machinery, information, etc.	can have a positive impact on those enterprises where it is necessary to analyze the functions of different specialists and coordinate them
Jidoka system	system of quality control application at all stages of production. First of all, it is based on automation and minimization of product defects due to poor quality of manual labor	relevant for use in enterprises where the share of manual labor is significant, resulting in prerequisites for the occurrence of defects
Procedures for standard operations	use of clearly regulated procedures for product quality assessment and quality control at each stage, which makes it easier and faster to identify problems in the production process	can be applied at enterprises where the approaches of “smart management” and rational use of resources are already used

Source: compiled by the author based on [1; 3; 6; 7; 8; 9]

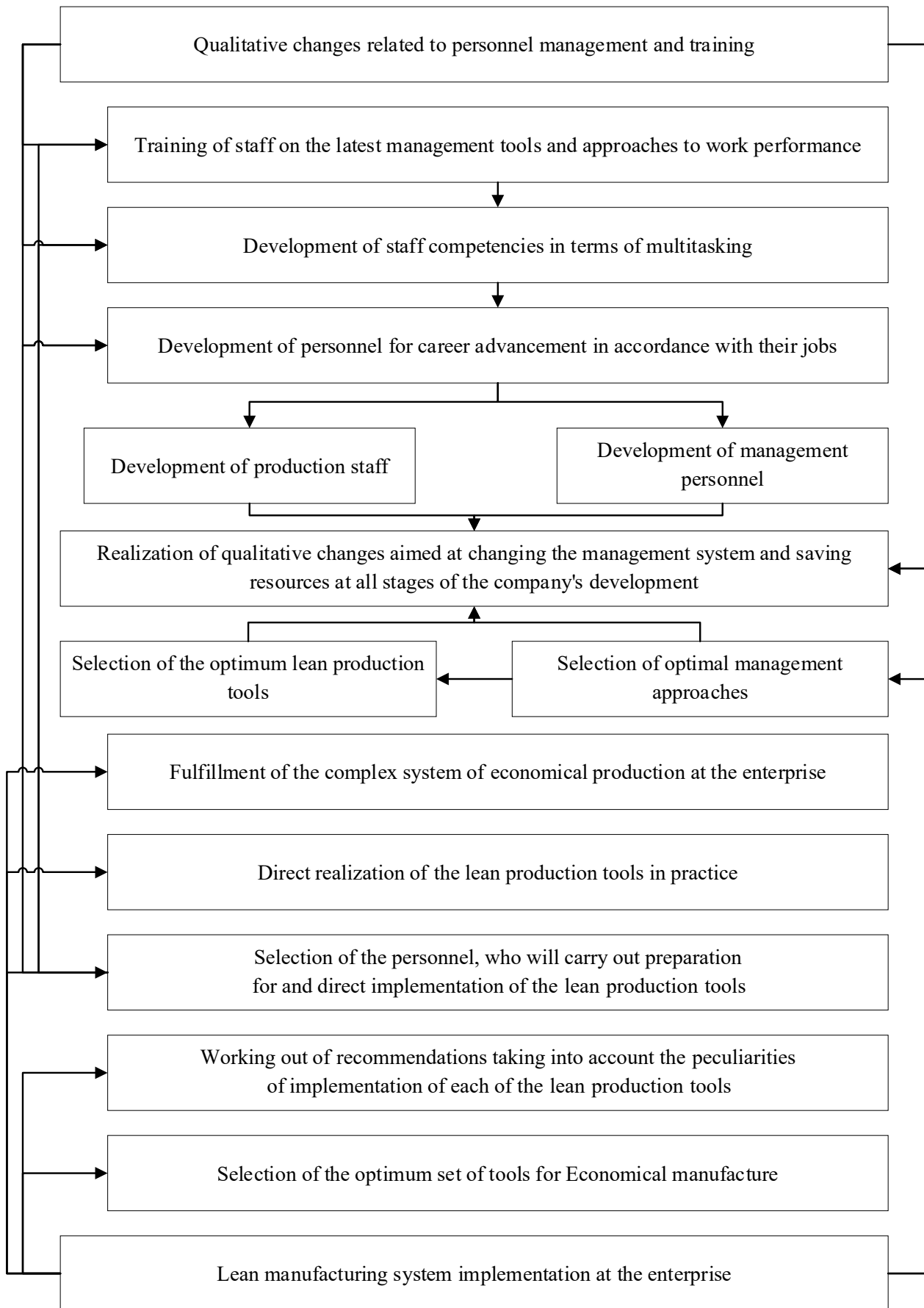


Figure 1. Interrelation of possibilities of implementation of lean production and personnel training for qualitative transformations at domestic enterprises

to the old methods of work. The layoff and payroll process will also result in costs. Only the remaining workers will be able to adjust to or accept all of the changes. Analyzing the examples already given, we can see that the difficulty of applying lean production lies not in the cost of implementation measures, but the human factor [9].

Consequently, we can assert that exactly on qualitative preparation of experts depends on prospectivity of the practical introduction of a system of economical manufacture. Irrespective of which concept or idea of lean production will be used, success depends on personnel training of experts for the implementation of lean production approaches. As a result, for the effective introduction of the lean production system, it is necessary to carry out personnel training.

Despite the proven functional diversity of lean production ideas, employees play a significant role in its implementation, as a strategic resource for the effective development of the enterprise. The concept of lean production focuses on the importance of treating employees with respect and creating ways for employees to think and propose improvements. At the same time, it becomes relevant to find ways to ensure the most effective communication between employees and the enterprise manager to ensure the best use of enterprise resources [10]. The manager will be able to achieve the goals of joint activities due to the fact that will multiply their physical and intellectual forces at the expense of the collective forces of subordinates and will be purposefully used. This is the task of a manager of any managerial level. The inability to build interpersonal relations, and dislike of one's partners and oneself lead to a lack of initiative, indifference, and a feeling of permissiveness. Realization of the necessity to urgently solve the problem of

improving people's behavior is the basis for the creation of a new corporate culture in the enterprise and the strengthening of loyalty. Recently it has become relevant and prestigious to talk about the formation of employee loyalty to the company and the development of strategic methods of retaining valuable employees. With a certain degree of conditionality, let's present a model of an economical production implementation, where we will single out the formation of personnel training subsystem as the main element (Figure 1).

As we can assert, based on Figure 1, prospects and possibilities of effective implementation of separate tools or complex approach to economical production at the enterprise depend on the ability of employees to apply these newest tools, their openness to new things, and orientation to training. That is why, to summarize, it is logical to point out that Ukrainian enterprises now need the latest tools that would reduce costs and optimize the use of intellectual capital, but for this purpose, it is necessary to train personnel and constantly improve the competence of enterprise employees.

Conclusions. Ukrainian enterprises require significant attention of scientists, as outdated equipment, inefficient management tools, and significant dependence on manual labor led to significant resource consumption and high cost of finished products. In view of this, it is advisable to introduce a modern approach to lean production, which can be implemented comprehensively or using individual tools, which are discussed in detail in the work. It is proved that the main factor hindering the introduction of lean production is the inexperience of staff in terms of such transformations. Therefore, the primary need is to train staff and explain to them the need to be open to change and innovation.

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