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Method of Assessment of the Management Efficiency of the Organization of Lean Production in a Textile Enterprise in the Conditions of Digitalization

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Abstract: This scientific article shows the methods of determining the management effectiveness of organization of economic production in textile enterprises in the conditions of digitization. Through these methods, ways of increasing the economic efficiency of textile enterprises have been shown.

Key words: textile industry, production, lean production, re-production, industrial network, economic efficiency, management efficiency, labor resource efficiency, management efficiency, management mechanism, localization of production.

Introduction. Targeted scientific research has been carried out in order to provide a solution to a number of problems aimed at the effective use of economic mechanisms of increasing resource efficiency in textile enterprises in the context of digitization. In particular, the implementation of the system of innovative technologies in the enterprises of the textile industry, the reduction of energy consumption in the industrial enterprises, the reduction of the material costs in the cost of the products produced in the industrial enterprises, the full use of the internal capabilities of the enterprises, and the increase of the economic potential based on innovative approaches are among these. Therefore, further development of research on improving the organizational and economic mechanism of increasing resource efficiency in textile industry enterprises is one of the main trends.

In lean production, the goal is not only to make a profit, but to create a product or service that is highly satisfying to the consumer, is useful for him, feels a need for him, and is valuable for him. For this, marketers constantly study the market, conduct surveys, study the experience of using a similar product, and study in detail similar products or services of competitors. Such studies allow to determine both the required product and its characteristics, description and functions. Determining the value of the product is precisely this - it is the first principle of lean production.

Another important principle of lean manufacturing is to create a value stream. It is with its help that simple production turns into cost-effective production. Here the main meaning is summed up in the word "flow". A value creation stream is a set of all operations performed to produce a given product. "Flow" means their continuity and unity.

A key principle of lean manufacturing thinking is value creation. Value is the behavior for which a consumer is willing to pay. A value-creating action must meet the following three criteria: First, the action is needed by the consumer. The second - this action changes the form / function of the Product / Service and thereby brings it closer to the final state. The third is that the action must be performed from the first time and without defects.

The next principle of lean production is to eliminate losses. Any action that does not create value is a waste.

8 types of losses are distinguished: overproduction; excess reserves; defects; actions that do not create value; wait; excessive movement; transport in transport; untapped potential of employees.

If the typical process is observed, it can be seen that all the activities that are not aimed at creating value occupy 50-90% of the production cycle.

With the formation of a socio-economic system based on digital platforms, the volume of creation and delivery of tangible and intangible benefits has increased several times over the conditions of the traditional system, which shows that this system is effective and promising. Analyzes show that as a result of digitization of socio-economic systems, the level of servitization will increase in the material production areas of the whole system, and this will lead to the whole system being based on services.[1]

The expansion and digitization of production in industrial sectors simultaneously ensures the rapid development of the textile industry and creates risks that affect the activities of the enterprises of the sector at different levels. In other words, solving tasks related to the digitization of management processes in new conditions requires a deep study of the theoretical aspects of the effectiveness of digital management.

Analysis of literature on the topic. Today, among the most common digital systems for effective organization of lean production in textile enterprises, ITS Internet, artificial intelligence, GLONASS/GPS system, blockchain platforms, Convoy, Flexport and other systems can be included. It is important to create theoretical aspects of the effectiveness of these management systems and improve existing approaches in solving practical tasks related to the introduction of digital technologies into the management process of the production sector.

First of all, it is necessary to correctly reveal the content of the field of knowledge related to management processes in textile enterprises, to determine the principles of a general approach to the assessment of the optimality of digitalization of management processes, to determine the criteria and to take into account the features of the development of efficiency evaluation methods. Before acquiring new technological tools and management software products, it is necessary to make sure that the costs incurred in them will bring a clear benefit, because the improvement of management through digitization tools should ensure the efficient use of existing capacities, funds and time.

The theory of management effectiveness has been studied by many scientists and researchers, who have developed the theoretical foundations and methodology of the issue.

One of the classic founders of the theory of scientific management, F. Taylor, can be cited as a contribution to the theory of management effectiveness, the idea of absolute compliance with scientifically developed standards, rules and regulations. [2]

The well-known German sociologist M. Weber made a significant contribution to the theory of criteria approaches to management processes with his "ideal bureaucracy" theory [3].

Another famous management theorist and the founder of the empirical school of management, P. Drucker's theory of "management by objectives" focuses on the following important elements [4]:

- determination of strategic goals;
- involvement of all employees in the process of developing plans and strategies;
- assessment of management efficiency based on final results.

L.I. Fedulova, in the process of researching criteria approaches to the assessment of enterprise management, singled out a number of factors affecting the overall management efficiency of the enterprise. [5]

Speaking about the principles of lean production, Jones and Wumek emphasize that the product or service is valuable. They say: «...Traditional organization and technology, dominated by an outdated idea of economies of scale, almost everywhere, the concept of value is misinterpreted. Managers around the world say, "We can do this job on the equipment we have." If consumers don't like it, we will lower the price or conduct a sensational advertising campaign." In fact, it is necessary to look at the concept of value through the eyes of the consumer and fundamentally revise it. [6]

Lean system and TOC, Lean system and 6 Sigma, Lean system, TOC and Kaizen, Lean system, TOC and 6 Sigma combinations are used in the management and organization of production systems in textile enterprises. In this way, the company's management tries to take into account the advantages of each approach. However, one approach is thoroughly mastered before moving to the format of using a combination of several approaches. [7]

Russian researchers Adler Yu.P. and Speer V.L. [8], Feldman G.N. [9] and others have studied the emergence of Lean from a historical perspective in their academic work. Foreign and domestic researchers have contributed to the formation of modern production approaches to the organization and management of the enterprise: G. Ford, F. Taylor, V. Shukhart [10], E. Deming [11], J. Juran [12], I. Goldratt, A. Feichenbum [13] and noted that it was influenced by the developments of others.

The business system approach is mostly used by large enterprises and corporate business structures. According to this concept, it is planned to apply the methods and tools of management of production systems to all processes and structures of the enterprise. The business system approach is used in conjunction with several other concepts, models, and approaches, such as the Lean system. It should be noted that Lean system and TOC, Lean system and 6 Sigma, Lean system, TOC and Kaizen, Lean system, TOC and 6 Sigma combinations are used in the management and organization of production systems. Thus, the company management tries to take into account the advantages of each approach. However, a single approach is deeply mastered before moving to a format that uses a combination of several approaches. [14]

Lean Production allows you to get an advantage in cost and price only if the domestic enterprise is on an equal footing with foreign competitors and operates on a relatively identical technological platform. No methods of modern business management will be able to ensure the growth of an enterprise’s market share if the supplied products do not satisfy the consumer in terms of their functional characteristics and high technology. On the other hand, having significant investment opportunities for the modernization of an enterprise, you can lose them if the production system, along with the production of products, multiplies losses, which greatly increase costs and cannot compete with foreign counterparts. [15]

According to the statistical indicators analyzed on the production of products of the textile industry, Uzbekistan as a weak point in the competition of the textile industry spiritual obsolescence of weaving machines, lack of qualified engineering and technical personnel, low specialization in the production of gauze, fabric products, it was found that the production of domestic fabrics aimed at sewing and knitting did not develop, the level of fiber assimilation in some regions was low, and the number of enterprises that introduced Quality Management in accordance with international standards was low. [16]

The experience of introducing cost-effective technologies shows that no matter how much employees improve the process, no matter how “economical” it is, new ways of eliminating losses are emerging. The process of improvement and value creation is accomplished through the efforts of employees. Employees are the main asset of the enterprise and the owners of the cultural value of economical production. [17]

Based on the experience of foreign companies, it can be concluded that the introduction of lean production technologies to ensure an increase in the efficiency of the production system will significantly reduce costs, increase labor productivity, improve the production process, achieve high financial performance, increase the competitiveness of the enterprise and achieve many other qualitative and quantitative changes. [18]

One of the basic principles of lean manufacturing and the first stage of its implementation is to define the qualities that make the manufactured product value for the consumer. This is where the implementation of lean manufacturing begins. Activities performed in the enterprise that do not create value for the customer are waste. Consequently, even the very initial stage of implementation of lean manufacturing already has an impact on increasing competitiveness. [19]

Improving the model of efficient use of production capacity, increasing labor productivity, enhancing corporate spirit and corporate culture in textile enterprises through the use of cost-effective means of production (Lean production) - 5S system. Substantiate the effectiveness of the introduction of the organizational system "5S" (sorting, compliance, cleanliness, standardization, improvement) of the concept of cost-effective production to manage the use of production capacity as an element of improving process quality and production culture in textile enterprises. [20]

Modern models of lean production can be formed by introducing lean production in textile enterprises and evaluating their management methodology. It includes the classic principles of lean manufacturing described above, the modern composition of lean manufacturing tools, the possible levels of understanding of lean manufacturing in the organization, the organizational components of lean manufacturing and the extent of changes required in the enterprise.

While studying the methodological aspects of applying lean production to industrial enterprises, it is appropriate to study the specific aspects of the organization of resource-efficient production in textile enterprises, which are the object of research.

Research methodology. In the article, scientific study of organization and management of cost-effective production in textile groups in the conditions of digitalization, comparative comparison, study of statistical data and economic comparison and analysis, logical thinking, scientific abstraction, analysis and synthesis, induction and deduction methods are widely used.

Analysis and results. Production efficiency in textile enterprises is formed simultaneously under the influence of many factors, among which the training of managers of the textile industry is of the greatest importance. Another important factor is the efficiency of the provided services. Because the quantity and quality characteristics of service capacity, the form of process organization and the level of perfection of the methods of operation have a great impact on the efficiency that is its final result. Along with the above, the amount of material resources used in the activity is also considered as one of the factors influencing the overall efficiency.

Based on the above, it is appropriate to express the indicated production efficiency (C_{xc}) in the form of a function related to practical actions and management efficiency (E_c) and capacity and means efficiency ($C_{вс}$) reflecting the quantity, quality, organizational structure.

$$\mathrm{C_{xc}} = f(\mathrm{C_{вс}}, \mathrm{Б_c})$$

Applying a systematic approach to the evaluation of the effectiveness of digitalization of production management showed that it is necessary to take into account the effectiveness of the components that make up it in their overall evaluation.

In general, the components that make up the management process can be grouped into 3 main groups:

1. The capacity and means of the production enterprise are included in the first group of digitalization of management processes. Of course, means of production play an important role in the organization of economic activity, but the effective use of these means depends more on the "human factor".
2. The second group of elements of the digitization of management processes includes the management systems in the production enterprise.

In other words, the organizational form of enterprise management is understood as this component. The following indicators describe the structural form of management: the number of elements (links) in the management system; the quality of each element in terms of its ability and ability to perform a specific task; organizational independence of individual groups of elements that can be considered as sub-system structures within the management system; the order of communication between management components and subsystems during operation; the limits of mutual location of control elements and subsystems, their transition to each other.

3. The third group of elements of the digitization of management processes is the sum of the relations of the managers in the production enterprise during the process.

This set of relations is manifested through the work methods, rights and functional obligations of managers. The following elements of the specified groups together create conditions for the digitization of management processes in enterprises and their effectiveness. A change in any of the elements in the composition of the groups leads to a breakdown of the system and thus to a decrease in management efficiency.

The analysis of the characteristics of the management process of textile enterprises allows to form the basic requirements for the efficiency criteria of its digitization. Each criterion should meet the following requirements: provide an evaluation icon for the effective solution of service management tasks; be sensitive to effective parameters to be determined and have a quantitative expression; having a small difference (dispersion), that is, the possibility of calculating with a sufficient level of accuracy without excessive cost and loss of time; to be able to give the most accurate assessment of the digitization of service management, taking into account all its aspects.

It should be emphasized separately that the criteria should not complicate the task of optimizing the management process of enterprises, and at the same time, their number should be sufficient to meet the important requirements for the management process. Currently, the basis for evaluating the performance of managers is a set of indicators or criteria that determine the selection of the most effective employees for the company, which is especially important in the conditions of optimizing the company's operations and reducing employees during the economic crisis. The criterion-referenced approach to management performance evaluation is the most effective approach to obtaining such evaluation results, and this approach is based on the establishment of defined parameters or competencies for evaluating employees.

In order to evaluate the effectiveness of the management process, criteria and indicators are determined based on the competencies required of employees for the effectiveness of the enterprise management system.

As in other processes, in the process of service management, a person tries to achieve a high economic result (financial, time, resource cost, etc.) at the expense of minimum costs, therefore, the criteria of management efficiency are selected within a variable limit. Accordingly, when evaluating the

effectiveness of digitization of the service management process, it is necessary to clarify a number of issues in advance: how much the new system can increase the efficiency of the management process; how quickly the management personnel in the system react to changes in conditions; what is the level of adaptation of the new system to sudden changes in conditions; the efficiency of the digitization of the management process is achieved at the expense of material costs; how much the new system can reduce service costs; level of material, financial and other cost savings due to the introduction of a new digital management system, etc.

Table 1. Classification of criteria for evaluating the effectiveness of the management system in enterprises

Group	Criteria Type	Features
1	Organizational powers	Indicators applicable to all employees of the enterprise: timely and complete fulfillment of their obligations
	Special powers	Compliance with the requirements of the specified type of activity or workplace
2	Quantitative powers	Evaluation coefficients based on achieved results
	Quality improvement powers	The quality and individual characteristics of the manager's activity
3	Lens features	Quality norms, standards and labor productivity coefficients used in any type of management activity
	Subjective powers	Evaluation based on the expert evaluation method by a special working group
4	Generalized (integral) powers	Information obtained on the basis of evaluation of various characteristics of the performed work and behavior
	Ordinary Powers	Performance indicators, behavior, level of labor productivity, labor discipline, absence of delays

The listed factors can be summarized into 3 main factor groups:

1. Benchmarks showing the immediate effect of digitizing the management process.

2. Criteria representing the technical indicators of digitization of the management process.

3. Economic expenses for the digitization of the management process and the criteria representing the possibility of its implementation.

Quick efficiency is defined as a set of indicators that determine the ability of digital control of the production process to solve planned and mandatory tasks on time and with high quality. Its content helps to determine the degree of conformity of the digital control system to the requirements of the real and rapidly changing environment based on the specific technical and software characteristics of the main devices and economic costs of the system.

Technical efficiency consists of a set of indicators that quantitatively reflect the technical aspects of digitalization of production process management. This refers to the technical and software capabilities of management system digitalization equipment and their convenience for managers working with this equipment in various conditions. Determining the technical efficiency of digitalization of the production management process means determining the degree to which the technical and software tools of its management are perfect at the expense of certain economic costs in the digital management system.

The system of criteria that determines the efficiency of optimization of management process digitalization in textile enterprises is an important criterion that shows the main results of management. A digital control system shows the interrelated and related capabilities of process components. Since the

management system is designed to provide the most favorable conditions for the implementation of management, the effectiveness of digitalization of service management should be evaluated based on the final results of the process.

The above-mentioned three main criteria groups: operational, technical and economic efficiency criteria can be considered taking into account the characteristics of activities in the service sector.

When organizing the production process, it is necessary to evaluate the rapid effectiveness of digitalization of the management process in advance. The main indicator of rapid efficiency ($С_т$)can be expressed as the relationship between the total costs for the displayed production ($Х_{ух}$) and the costs incurred for digitization ($Х_р$)

$$С_т = \frac{Х_{ук}}{Х_р}$$

Given the fact that the value of analogues of digital control systems differs less from each other in the presence of certain limitations, the potential of this indicator to be determined and evaluated is somewhat controversial. The use of the indicator of instantaneous efficiency (C_m) is usually limited to the inequality $X_p > X_{p\ min}$, which is due to the fact that it is not desirable to use a low-efficiency numerical control system.

Until these indicators are decided as an integral criterion for the overall efficiency of digitalization, it is recommended to accept as a criterion the ability of digital management to ensure minimum costs in changing the conditions of management decision-making, that is, the level of management tasks in a certain time ($P_б$). This criterion allows one of the most important tasks of the digital management system to determine how many solutions can be found for the implementation of processes in a short period of time with the lowest costs, and thus to obtain the maximum benefit in any situation. The quantitative value of this criterion is estimated based on the time spent on organizing the service process (t_x) and the characteristics of the production process conditions (t_y)

$$Р_у = Р(\boldsymbol{t_x} < \boldsymbol{t_y})$$

It is appropriate to include the following criteria among the criteria of rapid efficiency of the digital control system of production processes: rapidity; scope coverage; continuity; stability; information transfer (processing) ability; mobility (mobility); accuracy; flexibility.

The assessment of the technical efficiency of the digital control system consists in the analysis of the determination of its technical solutions - technical capabilities and level of excellence. The optimality of technical management tools largely depends on the efficiency of the system. Therefore, the assessment of the technical efficiency of digital control systems is inextricably linked with the determination of their operational efficiency.

In addition to the criteria of speed and technical efficiency, we believe that it is appropriate to use the following criteria to evaluate the economic efficiency of digital control systems.

1. The total cost $Х_{ум}$for the digital control system is expressed by the following relationship:

$$Х_{ум} = Х_я + Х_ж + Х_ф + Х_б$$

Here: $Х_я$ is the cost of creating a digital control system, purchasing and testing test samples;

$Х_ж$– digital management system introduction costs;

$Х_ф$– digital management system use (exploitation) costs;

$Х_б$ – other expenses.

2. Direct (real) economic effect (C_p) is the effect of savings in management activities through the introduction of digital flow management, which can be determined by the following relationship:

$$C_р = C_1 + C_2 + C_3 + C_4$$

Here: C_1 is the saved volume of expenses for service personnel;

C_2– saved volume of costs for decision-making, documentation and data collection for accounting work;

C_3– cost savings for employees in the main activity;

C_4– saved volume of other expenses.

3. Indirect economic efficiency ($C_б$) is the efficiency obtained from the process of creating products as a result of the digitization of the production management process, and it is expressed by the increased profit due to cost savings and reduction in the number of personnel. The indirect economic effect is determined based on the following relationship:

$$C_б = C_{фо} + C_{хт} + C_{пқ}$$

Here: $C_{фо}$ is the increased profit;

$C_{хт}$– saved amount of expenses;

$C_{пқ}$is the efficiency saved due to personnel reduction.

4. The payback period for digital production management costs is determined based on real (T_p) and indirect ($T_б$) economic efficiency:

$$T_р = \frac{X_{ум}}{C_р}$$

When considering methods and criteria for evaluating the effectiveness of digitalization of production management, it is not enough to evaluate its operational, technical and economic efficiency. It requires a comprehensive evaluation of the entire system, taking into account all types of performance, that is, generalized indicators of the suitability (or non-suitability) of the system being evaluated. As the most important of these indicators, it is necessary to take the rationality of the implementation of the digital management system.

It is appropriate to express the rationality of introducing a digital control system through the following connection:

$$P_{рб} = \frac{C_{ярбт} - C_{эбт}}{C_{эбт}} = \boldsymbol{g} \cdot X_{ярбт} - X_{эбт} - \boldsymbol{C}_р - \frac{C_б}{C_{эбт}}$$

Here: $C_{ярбт}$is the efficiency of the new digital control system;

$C_{эбт}$is the effectiveness of the old management system;

$\boldsymbol{g}$ is the coefficient of comparison of system operational efficiency and system costs.

Failure to fulfill the above link condition will result in the cost of creating a digital control system exceeding the level of operational efficiency. Therefore, it is necessary to find ways to reduce the costs of digital management of services.

The validity of the introduction of newly developed digital control systems can be assessed by the increase in the effective service unit price ($Б'_{схб}$).

Effective service unit price ($Б'_{схб}$) is determined as follows:

$$Б_{схб} = \frac{Х_{ум}}{К_{скэс} \cdot С_{бт}}$$

Here: $К_{скэс}$is the number of effectively functioning elements;

$С_{бт}$– control system efficiency.

The increase in the price of an effective service unit ($Б'_{схб}$)is determined based on the following relationship:

$$Б'_{схб} = \frac{Х_{ум}}{К_{скэс} \cdot С_{эбт}} - \frac{Х_{ябт}}{К_{скэс} \cdot С_{ярбт}}$$

If $Б'_{схб} > \mathbf{0}$ according to the above connection, the digital control system can be recognized as rational. Practice shows that in determining the rationality of the introduction of the digital management system and the value of the increase in the costs of the new digital management system at an acceptable level, it is appropriate to consider its development in a sequential, step-by-step manner. In this case, separate stages of the introduction of a promising digital management system are independently checked on the basis of criteria.

Summary. On the basis of the above theoretical and methodological studies, it was determined that in today's digitization of the economy, it is possible to introduce digital management systems for textile industry enterprises and evaluate the efficiency of this system. By evaluating the effectiveness of the digital control system based on the developed methodology, the introduction of digital control systems of the production process into practice allows the formation of a profitable digital control system without excessive costs. Provision of textile enterprises with material resources at the same time, in the necessary quantities, of the specified quality and at the same time, as well as their rational use ultimately has a comprehensive effect on its economic development and progress. The development of the enterprise, development and economic strength, in turn, creates the basis for the stabilization of the economy of our republic.

In our opinion, economic analysis is of great importance in establishing the effective use of material resources, and by analyzing the extent to which material resources are used in the enterprise, it is possible to identify unused internal opportunities in order to save material resources spent on manufactured products.

We believe that the main tasks of implementation of economical production in textile enterprises, economical management of material resources should be focused on the following: determining the level of supply of the enterprise with necessary material resources; determining the level of complexity, quality and regularity of the supply of material resources to the enterprise; to determine the indicators of effective use of materials and quantitatively calculate their impact on the volume of the product and its cost; in assessing the use of raw materials, fuel and materials, identifying unused internal capabilities.

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