Role of Implementaton of "Lean Production" in Light Industry

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Abstract
In the paper researched the role of implementation of "lean production" in light industry and was examined the theoretical and practical aspects of the lean manufacturing methodology. the scientific approaches of various authors are presented. The author proposes to use lean manufacturing to improve the economic efficiency of industrial enterprises. Also has been calculated Correlation analysis of economic indicators of light industry enterprises of the Republic of Uzbekistan and forecasted of the activity of light industry enterprises in the Republic of Uzbekistan.

Keywords
Lean production, production system, concept, efficiency, philosophy of success.

I. Introduction

The need to develop and implement projects in the field of "lean production" is associated with the need to ensure the high competitiveness of a modern enterprise, to strengthen global competition in traditional sales markets. For this purpose, it makes sense to turn to the world experience in the field of lean manufacturing. It is thanks to the consistent implementation of the ideas of Deming, Juran and Kaori Ishikawa and other gurus that Japan, a country more than Ioor in natural resources and ravaged by war, has become one of the richest countries in the world.

Deming, one of the leading experts in statistical quality assurance, was invited in 1950 by the Japanese Union of Scientists and Engineers to participate in a program to rebuild Japanese industries. There Deming proposed a quality management program and developed the principle of continuous quality improvement, which revolutionized the Japanese industry. Crosby in 1964 proposed the "0 defects" program. Feigenbaum developed the principles of total quality management and parallel (simultaneous) engineering. Ishikawa invented a "circle of quality", proposed diagrams "cause - effect" (Ishikawa diagram), developed a concept of quality management, in which the entire team of the enterprise participates. Juran developed the principle of "quality triads". Messing proposed the "quality guide" as the main document of the enterprise quality assurance system [1].

T. Conti analyzes the most famous models of quality: from the ISO model, on which certification is based, to the model of total quality management (TQM), and gives examples of their practical use [2]. G. Taguchi developed the ideas of mathematical statistics related, in particular , to statistical methods of experimental design and quality control. The Taguchi methods (Taguchi himself calls his concept "quality engineering") represent one of the fundamentally new approaches to solving quality issues. The core of his philosophy is to improve quality while reducing costs. The economic factor (cost) and quality are analyzed together. Both factors are related by a common characteristic called the loss function. The Taguchi methodology is based on the recognition of the factor of unequal value of the indicator within the tolerance. The quality loss function is a parabola with a vertex (losses are equal to zero) at the point of the best value (nominal value), with distance from the nominal value, the losses increase and at the field boundary reach their maximum value - losses from product replacement. The analysis considers losses from both the consumer and the producer. Taguchi methods allow you to design products and processes that are insensitive to the influence of so-called "noise", that is, variable factors that cause variation in parameter values that are difficult, impossible or expensive to change. From an economic point of view, any, even the smallest "noise" will reduce profits, since this increases production and warranty costs.

It is thanks to the above authors that quality management has developed in its modern sense. The contradiction between improving quality and increasing production efficiency was overcome - the use of new management ideas made it possible to simultaneously improve quality and reduce production costs.

In TPS, LEAN and Lean Manufacturing, which are the same thing, they understand quality not as a separate system, but as an integral part of the whole production system of the enterprise. Techniques and tools developed by scientists to improve quality are adapted and effectively applied in Lean Production to improve other process parameters: technical safety, cycle time, process costs, morale for personnel. Therefore, the founder of the production system of the Taiota company, Tyichi Ono, formulating the types of losses that ultimately reduce the operational efficiency of the enterprise, put the losses from the production of rejected products on a par with six more types of losses: excessive processing, unnecessary movements.

Description of the approach The system of doing business, which began to take shape in 1945 with the arrival of Tyichi Ono at Toyota. The main emphasis is placed on the formation of the philosophy of the permanent, Lean Production (translated from English Lean - lean, economical, well-oiled, rational). This is how American managers called the system of principles, and In Russian practice, the Lean system began to be called Lean Manufacturing, which in a slightly modified and adapted form is TPS with an emphasis on continuous tools, tools and methods.

First, domestic enterprises are aimed at a quick result from the introduction of Lean Production tools that would not fundamentally change the situation at the enterprise and would not require changes at the level of the top management of enterprises.

Secondly, enterprises are ready to invest significant resources in technologies and equipment, which, in the opinion of managers, make it possible to make a significant leap forward, while constant and gradual improvement is a long process with an unclear economic effect.

Thirdly, domestic industrial enterprises take up the tools of "lean manufacturing" and underestimate the importance of the philosophy of "lean manufacturing", while Toyota's success is based on the philosophy of lean the right results, increasing the value of the organization through the development of employees and partners, the constant solution of fundamental problems stimulates the organization's continuous learning). If "lean manufacturing" starts using simple tools with quick results and philosophy, which are

guided by the leaders, then the company staff becomes convinced of the effectiveness of "lean manufacturing", then the thinking and culture change, which allows to start implementing more complex tools, and repeats.

II. Literature review

After the war, in Japan, the level of demand in the economy was at a low level, so it was impossible to reduce the cost of production at factories using economies of scale.

Scientist John Krafchik coined the term Lean Production in 1988 to refer to Toyota's manufacturing methods.

Russian economists S.V. Ponomarev, S.V. Mishchenko, Vakhrushev V.[5], Okrepilov V.[8], Burenina IV, Battalova AA [9], Battalova A.A.[10] consider issues of product quality management, including quality management tools and methods.

Applying of artificial intelligence in the textile industry were studied by Yldashev, N., Nabokov, V. I.[11;12;13], Estimation methodology of efficiency of production capacity were researched by Kirill, K., Bobir, T., and Ziedulla, H. Financial security of industrial enterprises and features of investment in mutual fund were investigated by A.Burkhanov [17], B.Tursunov [15;16] and others.

A number of other researchers have a different point of view. For example, V.G. Versan. He made a significant contribution to the development of the theory of product quality management, standardization, certification and technical regulation. But Wumek D., Jones D. [1], Imai M. [7], Glichev A.V. is one of the initiators of the introduction of the term qualimetry to name the science of quality measurement. It is directly related to the emergence of the ISO 9000 series of quality management standards. But Okrepilov V.V. for the first time he highlighted the place and role of standardization and metrology when dealing with objects related to the nanoscale.

Other scientists V.E. Rastimeshin and Kupriyanova T.M. studied in detail the system "Universal productive equipment maintenance". The main components of this system are: individual improvements, self-service of equipment by operators, scheduled maintenance, personnel training, control at the initial stage, service focused on product quality, safety and environmental control, activity of the sector not directly related to control.[2]

Foreign scientist Vumek D.P. Examines in detail the issues of lean production, such as the competent construction of effective and mutually beneficial relations between suppliers and consumers, methods of getting rid of losses and the prosperity of the company. On the other hand, economist T. Jackson discusses the implementation of hoshinkanri, one of the most effective systems for developing strategy and deploying plans within an organization. This technology is still used by Toyota, Komatsu and other companies.[3]

Japanese scientist Imai M. studied the continuous improvement of the most important aspects of the organization's activities, directly related to the creation of added value and relationships with consumers, first of all, these are production processes and trade contacts (gemba kaizen). He also introduced the term "kaizen" and promoted Japanese-style management in various countries.[6]

A.N.Grachev systematized knowledge and experience in the use of 5S, which includes sorting, self-organization, systematic cleaning, standardization and improvement.[4]

Researcher Tapping D. examines the implementation of Lean Production in the office. He believes that with the correct use of Lean Production tools, it is possible to bring an enterprise to a new level of development, namely to increase labor productivity, increase the speed of order processing, as well as customer satisfaction.

III. Analysis and results

The introduction of "Lean production" is important not only for the development of industry production, but also for improving the management of innovation. In this context, the author has practically studied the state of development of enterprises, in order to determine the main directions for improving the efficiency of management at enterprises of light industry of the Republic of Uzbekistan.

Economic indicators are selected on the basis of signs affecting the production of products-Y of enterprises of the light industry of the Republic of Uzbekistan, in particular, the number of enterprises - X_1, the cost of goods sold (goods, works and services) - X_2, net profit from the sale of products (goods, works, etc. services) - X_3, initial cost of fixed assets - X_4 and depreciation cost of fixed assets - X_5. Based on the selected factors, the degree of their relationship can be determined by means of the correlation coefficient in the EXCEL program (table 1).

Table 1 : Correlation analysis of economic indicators of light industry enterprises of the Republic of Uzbekistan

	Y	**X_1**	**X_2**	**X_3**	**X_4**	**X_5**
Y	1					
X_1	0,933385	1				
X_2	0,9836894	0,7681273	1			
X_3	0,9693652	0,7472270	0,6935444	1		
X_4	0,9422892	0,780038	0,7812438	0,7762072	1	
X_5	0,9166932	0,780446	0,6701967	0,5661216	0,7926793	1

These tables illustrate that there is a strong relationship between the effective factor and the selected factors, the correlation between the factors is dense and the conditions | r _ (⟦x_ (1,) x⟧ _2) | <0.8 are satisfied, after determining the absence of multicollinearity between the factors, you can create regression equation. The regression equation shows the presence of a functional relationship between the effective factor and the selected factors. To create a regression equation, it is advisable to use the most convenient program Eviews today.

In addition, it is necessary to check the reliability and adequacy of the equations of the identified regression, based on certain criteria. When evaluating the model, the Least Squares (Gauss-Newton / Marquardt steps) methods were used, based on the identified information criteria "Akaike", "Schwarz" and "Hannan-Quinn".

Table 2 : Results of the reliability and adequacy of the regression equation based on criteria

R-squared	0.896353	Mean dependent var	108.6350
Adjusted R-squared	0.879331	S.D. dependent var	56.00613
S.E. of regression	3.682046	Akaike info criterion	9.794668
Sum squared resid	84.91895	Schwarz criterion	9.158121
Log likelihood	-28.76801	Hannan-Quinn criter.	9.724103
F-statistic	27.80241	Durbin-Watson stat	1.852415
Prob(F-statistic)	0.001270		

According to table 2, the analyzed model "Akaike-AIC = 9.79", "Schwarz-BIC = 9.16" and "Hannan-Quinn-HQ = 9.72" and the sequence of elements of the first order of the statistical criterion, allowing the autocorrelation test - Durbin-Watson-DW = 1.85, the identified adequate regression equation is expressed as follows:

Y = 211,99 + 0,96 · X_1-0,0087 · X_2 + 0,079 · X_3 + 0,043 · X_4-0,064 · X_5 (1)

here: Y is the volume of production of products of enterprises;
X_1 is the number of enterprises;
X_2 - the cost of goods sold (goods, works and services);
X_3 - net proceeds from the sale of goods (goods, works and services);
X_4 - initial cost of fixed assets;
X_5 is the depreciation cost of fixed assets.

According to the regression equation (1), it was revealed that in the current conditions an increase in the number of created enterprises by 10 units contributed to an increase in the volume of production to 9.6 units, due to net proceeds from the sale of goods (goods, works and services) by 0.8 units and the initial cost of fixed assets increased by 0.4 units.

However, in turn, due to a decrease in the cost of products (goods, works and services) and depreciation of fixed assets by 100 units, this allowed an increase in the volume of production at enterprises by 0.9 and 6.4 units, respectively.

If the analysis is made on the basis of a functional relationship between net profit - Y of light industry enterprises, as well as, as factors influencing it, that is, attracted investments in enterprises - X_1, profit before tax - X_2, period expenses - X_3 and the initial cost fixed assets - X_4, this will allow making accurate scientific conclusions on the state of the selected industries. For this, the correlation between the selected indicators is determined using the EXCEL program, and the result is presented in Table 3.

Table 3 : Results of the correlation between net profit and factors affecting it

	Y	**X_1**	**X_2**	**X_3**	**X_4**
Y	1				
X_1	0,694600779	1			
X_2	0,986158078	0,742160898	1		
X_3	0,733681506	0,790585557	0,632628038	1	
X_4	0,712455227	0,72804432	0,71287124	0,792088743	1

According to the results of Table 3, the net profit and expenses of the period of enterprises are high (0.986158078) and with other factors, respectively r r_ (Y, X_1) = 0.695, r_ (Y, X_3) = 0.734 and r_ (Y, X_4) = 0.713 has a tight medium bond. Based on the correlation between these factors, we will draw up a regression equation. According to him, the regression equation is defined as follows:

Y = 211,99 + 0,96 · X_1-0,0087 · X_2 + 0,079 · X_3 + 0,043 · X_4-0,064 · X_5 (1) (2)

where: Y is the net profit of enterprises; X_1 - the volume of investments attracted to enterprises; X_2 - profit of enterprises before income tax; X_3 - expenses of the period of enterprises; X_4 is the initial cost of fixed assets.

If we focus on the revealed regression equation (2), an increase in investment in light industry enterprises, profit of enterprises before income tax and the initial cost of fixed assets by 10 percent, then the net profit of enterprises will lead to an additional growth of 2.1 percent, 9, 2 percent and 0.22 percent, respectively. It is worth noting that during the research period, an increase in the costs of the period of enterprises included in the structure of the association was revealed, an increase in the costs of the period by 10 units led to a decrease in the net profit indicator by 5.3 units. In this regard, it is advisable to provide enterprises with saving technologies and use alternative energy.

Our analysis shows that the development of a strategy for the development of innovative processes in enterprise management will provide a competitive environment for the national economy. As a result, not only the content of structural changes in the economy will be enriched, but also the basis for a broad and comprehensive development of economic activity, spheres and industries, from a socio-economic point of view. For this, of course, it is advisable to determine the prospects for the activities of light industry enterprises of the Republic of Uzbekistan, based on current requirements.

The net profit of light industry enterprises is determined by the above model (2), which determines the future change in Y:

$$Y = 16{,}8 + 0{,}211 \cdot X_1 + 0{,}917 \cdot X_2 - 0{,}53 \cdot X_3 + 0{,}022 \cdot X_4 \quad (2)$$

where: Y is the net profit of enterprises; X_1 - the volume of investments attracted to enterprises; X_2 - profit of enterprises before income tax; X_3 - expenses of the period of enterprises; X_4 is the initial cost of fixed assets.

The regression equation for the change associated with the time of each selected factor is determined by:

Investment in enterprises:

$$X_1 = 56{,}1 + 11{,}2 * t;$$

Profit before tax:

$$X_2 = -11{,}2 + 35{,}3 * t;$$

Period expenses:

$$X_3 = -57{,}9 + 32{,}7 * t;$$

Initial cost of fixed assets:

$$X_4 = -451{,}1 + 406{,}7 * t.$$

The forecast of changes in the net profit of light industry enterprises in the Republic of Uzbekistan for the period 2019-2025 has been calculated, including the calculated cost for each factor in the model (2).

According to Table 4, it can be seen that by 2025, the net profit of light industry enterprises in the Republic of Uzbekistan is expected to increase by 36.4 percent compared to 2019, the volume of investments - by 29.9 percent and expenses of the period - by 45.3 percent, respectively. , they will reach 592.5 billion soums, 291.3 billion soums. and 628.8 billion soums, which is reflected in the table below.

Ttable 4 : Forecast of the activity of light industry enterprises in the Republic of Uzbekistan

Years	Net profit, billion soums	Investments in fixed assets, billion soums	Profit before income tax (loss), billion soums	Cyclical expenses, billion soums	Initial cost of fixed assets, billion soums
2020	460,7	235,3	553,6	465,3	6056,1
2021	487,1	246,5	588,9	498,0	6462,8
2022	513,4	257,7	624,2	530,7	6869,5
2023	539,8	268,9	659,5	563,4	7276,2
2024	566,1	280,1	694,8	596,1	7682,9
2025	592,5	291,3	730,1	628,8	8089,6

It should be noted that the modernization of production and the reduction in administrative costs in this regard, is expected to increase the ROI of the period by 1.45 percent by 2025 compared to 2019.4

IV. Conclusions

Improving the efficiency of vertical integration management at enterprises depends on the effective work of the system for improving the antimonopoly and competitive environment of functioning firms, enterprises, organizations and corporations. Along with this, the competitiveness of the national economy is determined by the level of development of private property, the system of state guarantees, as well as a high level of innovation policy and a strong institutional environment in the country.

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. Accordingly, the development of the domestic industry should proceed in parallel: on the one hand, raising the scientific and technological level, and on the other, rationally managing business processes. Lean Production can to a greater extent ensure the implementation of the second direction.

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