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To cite this article: N.L. Ketoeva *et al* 2019 *IOP Conf. Ser.: Earth Environ. Sci.* **288** 012062

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Lean production instruments as basis for resource-saving management

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Abstract. Russian power companies and those partnering with the power industry generate a strategic objective to optimize production and management costs while maintaining high quality of the products and services conforming to the international and domestic standards. This inevitably requires reorganization of business processes at all management levels.

Sustainable development and energy efficiency of the Russian economy depends on a number of factors; one of the essential factors is effective management of production enterprises.

The key method for improving the management efficiency is an array of instruments applied in leading industrialized countries worldwide and known as the "lean" production ("lean manufacturing") concept.

In the last 20 years, Russian production enterprises have tried to introduce both lean production methods, and separate tools in practical management. Large power corporations, such as Gazpromenergoholding, Rosatom arrived at meaningful positive results. Lean production practices in Russia are topical for research into methods and primary ways of adopting the lean production (LP) instruments by the domestic industry.

The objective of the research is to classify and provide quantitative assessments of expected positive economic effect through adoption of the lean production instruments at nuclear industry enterprises.

The methodological framework for the research included lean production state standards (GOST) and research reports by foreign and domestic authors doing research into the LP concept, models and instruments.

The information base of the research consists of data from foreign and domestic scientific publications, Rosatom State Corporation's official data and open data from professional communities' websites.

Keywords: lean production concepts, business processes, lean production instruments, sustainable development of a power company, resource-saving management, quality management.

Practical application of the lean production instruments by Russian nuclear power enterprises is conditioned by a range of specific features of the Russian industry. They are:

- specifics of the Russian ISO 9001:2015 standards;
- market orientation of the power companies and those partnering with the power industry;
- rise in electricity, gas and water utility tariffs;
- lower level of labor productivity as compared to that in the leading industrialized countries and BRICS countries;
- modest corporate culture and loyalty to the company;



- material incentives/discouragement orientation of employees, etc.

The practical application of the LP instruments at Russian nuclear power enterprises is aimed at achieving top economic results. Table 1 summarizes improvements to the company's internal processes turned into economic results, which are equally important to the partnering enterprises.

Table 1. Effect of the LP instruments on the company's internal processes and the results achieved

Internal processes of the company using the LP instruments	Achieved results: economic, information	General result
Timely execution of orders	Shorter cumulative lead time	RESOURCE SAVING
Increase in labor productivity	Higher operational efficiency	
Reduction of changeover time	Longer in-service time	
Operating and management cost saving	Cost reduction	
Optimization of raw material stocks	Reduced requirement for current assets	
Minimization of losses due to spoilage	Decreased costs	
"Transparency" of production processes and management	High-quality products	
Full compliance with occupational safety rules	Zero rate of accidents	

Implementation of the lean production management system (LPMS) as a resource-saving management tool is aimed at increasing the energy efficiency; research, development and production companies of the nuclear industry are chosen as a platform for studying the experience in application of the "lean production" concept.

According to the research at the Russian nuclear power enterprises the practical application of the LP instruments is positive and exerts an impact on the labor productivity, quality of products (services rendered), contributes to resource saving and increases the company's economic activity.

The external factor that encouraged the Russian enterprises to apply and adapt the LP instruments is the necessity to integrate partners into a single system, create partner alliances, increase effectiveness of supply chains management, and ensure high quality of products and services. The internal factors include the tough necessity to optimize production management costs, increase management efficiency and raise labor productivity.

The application of the LP instruments at the R&D and production enterprises under the Rosatom State Corporation involved the use of such tools as the Value Stream Mapping (VSM), the Workplace Organization (5S), the Total Production Management (TPM), the Single Minute Exchange of Die, (SMED), statistic analysis and process improvement (Six Sigma), and the Just-in-time system.

The energy efficiency buildup program based on the LP instruments in the electric power division of the Rosatom State Corporation (AO Rosenergoatom Concern) resulted in an increase in own power production in 2017 (by 3,3% in contrast to 2016) and an increase in labor productivity from 7,04 million rubles per person in 2016 up to 8,65 million rubles per person in 2017 [1, p. 24, 42].

The number of the LP instrument used by Russian companies is steadily increasing (the rate of increment of the companies using three – four tools amounted to 5% in recent years as compared to 2008, and the number of the enterprises applying five – six tools increased by 6% for the same period) [1, p. 22].

A little over one third of Russian enterprises use the LP instruments. Russian R&D and production enterprises of the nuclear industry make use of foreign experience in applying the LP instruments through their adaptation to Russian specificities.

A peculiarity of the use of the LP instruments at R&D and production companies of the nuclear industry is setting up an LP management system based on a combination of six tools. Firstly, it is Kaizen approach including the TPM and Kanban systems.

The other aspect of development of the LP management system is the application of the Lean system/lean production system by the Russian R&D and development companies targeted to

optimization of the company's expenditures and elimination of waste, and correspondingly, growth of the consumer value.

Table 2. Cost structure for application of LP instruments by Rosatom organizations

Cost of LP instruments	Structure, as percentage of total		
	2015	2016	2017
Lean system/lean production	23,0	23,5	23,4
Business system	19,8	19,4	19,7
TOC	10,1	10,0	10,1
Six Sigma	12,8	12,9	8,9
kaizen	21,3	20,6	23,0
kanban	13,0	13,6	14,9
Total	100,0	100,0	100,0

The table is made up on the basis of Rosatom experts' opinions.

The Business system is the platform for management of the corporation's production systems. It is integrated with the Lean system/lean production, Six Sigma and TOC. Thus, the combined use of several LP instruments based on several approaches takes place at a practical level.

The application of these LP instruments yields favorable results in the company's activities. We see the following exponents as criteria of economic results: rate of wage-cost creep, rate of change of the product cost, rate of change of spoilage in actual output, rate of change of labor productivity.

Depending on the structure of the LP instruments applied, the management system requires a specific business mechanism. New controlling mechanisms influence internal transformation processes at all company's management levels.

Focus on continuing growth in energy efficiency of an R&D company in the nuclear industry is conditioned not only by the external factors, but also the company's internal processes. The market orientation of the R&D company stipulates compliance of the internal processes to market requirements; in case of deviations the company takes corrective actions using the LP instruments. The continuous change of the market processes and the company's strive for compliance with the market requirements necessitate implementation of an algorithm of continuous improvement of the organizational mechanism and development of the LP instruments by R&D companies and production associations of the domestic industry.

Development and buildup of the LP instruments by the companies of this type implies implementation of a step-by-step improvement model for the research and production process taking into account the influence of the external factors, assessment and management of the internal processes from the perspective of the market requirements.

The step-by-step improvement model for the research and production process implies setting up a cross-functional group that assesses and chooses the LP instruments to achieve certain economic results.

Many Russian companies have been developing a production system, in our case a research, development and production system, based on the LP concept and instruments. The external factors and the company's economic capacity contribute to recognizing the importance of implementation of the LP concept, the organizational and economic mechanism of application of the LP instruments, and the level of internal management reforms.

References

- [1] Annual report 2017, AO Concern Rosenergoatom.
- [2] Safronova K.O. Lean production adaptation under conditions of economic instability. Thesis for PhD in Economics.
- [3] <http://www.rosatom.ru> portal.