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INNOVATION THROUGH KAIZEN: IMPLEMENTING TECHNOLOGICAL INNOVATION

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Abstract. *The work is devoted to the study of the effectiveness of the kaizen philosophy in the context of the introduction of technological innovations. The relevance of the study is determined by the need for constant updating of production processes and increasing the competitiveness of enterprises in a dynamic technological environment. As a result of the study, it was established that the kaizen philosophy is an effective tool for the implementation of technological innovations. Combining incremental improvements with systematic process analysis has been found to minimize innovation risks and ensure continuous optimization. In addition, it was established that an important role in the success of the implementation of innovations is played by the involvement of personnel, the creation of a favorable organizational culture and the use of modern project management tools.*

Key words: *Kaizen, technological innovation, innovation implementation, change management, production, efficiency, quality*

Introduction

The problem of identifying and implementing effective innovative solutions in heavy engineering that meet the principles of Kaizen is closely related to scientific and practical tasks, since innovation is a key factor in increasing competitiveness and production efficiency. The scientific task is to research and develop new technologies and processes that can be integrated into production lines with minimal cost and interruption. This includes analyzing current processes, identifying areas for improvement, and developing innovative solutions that meet Kaizen standards, such as continuous improvement and elimination of waste. The practical task includes implementing these innovations in enterprises, training staff in new ways of working, and adapting the corporate culture to the Kaizen philosophy. It also requires the development of customer feedback mechanisms to assess the effectiveness of

innovations and their impact on product quality. It is important that innovation is not only technological but also organizational, including changes in management, communication and work processes.

Analyzing the latest research and publications, it can be noted that considerable attention is paid to the integration of Kaizen principles into the development of innovative technologies in mechanical engineering. One of the key aspects is the search for ways to optimize production processes, which includes the introduction of the latest technologies and approaches to quality management. Scientists and specialists are actively researching the possibilities of using Kaizen to improve production efficiency, in particular in heavy engineering [1]. However, despite significant progress in this area, there are unresolved parts of the overall problem that require further investigation. For example, an important aspect is the integration of innovative solutions into existing production systems without significant investment of time and resources. Also, more attention needs to be paid to the development of methods for assessing the impact of innovations on product quality and customer satisfaction.

The aim of the work is to review the current state of application of Kaizen principles in heavy engineering and identify key areas where they can lead to significant innovations, analyze opportunities for the implementation of technological innovations in production processes that correspond to the Kaizen philosophy, with an emphasis on continuous improvement and elimination of losses, identify strategies for integrating innovative solutions into production, taking into account economic efficiency and impact on quality Products. To investigate how the principles of kaizen can be successfully applied to the implementation of technological innovations, as well as to determine the factors that affect the effectiveness of this process.

Main text.

Innovations in heavy engineering can be diverse and encompass a wide range of changes, from technological to organizational. Technological innovations can be the latest materials, automated control systems, robotic equipment, etc. Use of composite

materials, ultralight alloys, or materials with improved properties such as high strength, corrosion resistance, or heat resistance. Implementation of integrated manufacturing execution systems, which may include elements of the Internet of Things (IoT) to monitor and optimize production processes. The use of industrial robots to automate complex or dangerous manufacturing operations, which increases safety and efficiency.

Organizational changes: optimization of supply chains, reviewing and improving logistics processes to reduce costs, increase delivery speed, and improve overall delivery efficiency; improvement of the quality management system, development and implementation of quality management systems that meet international standards such as ISO 9001 to ensure high quality products and services.

The classification of innovations can be based on various criteria, such as the degree of novelty (radical vs. incremental), the scope (product, process, organizational), as well as the source of innovation (internal development vs. external acquisition). It is important that innovations in the field of heavy engineering require careful planning, analysis of current processes, identification of needs and opportunities for improvement, as well as involvement of personnel in the process of implementing changes. This allows not only to increase production efficiency, but also to ensure the sustainability of the enterprise in the market.

To implement innovations, it is necessary to analyze the current state of production and identify areas for innovation in mechanical engineering require an integrated approach, which includes: 1) Manufacturing Process Diagnostics: Evaluation of current processes for efficiency, speed, quality, and costs. Using Lean Manufacturing and Six Sigma methods to identify inefficiencies and losses; 2) Identification of bottlenecks: Identification of production steps that limit overall productivity. These can be outdated machines, undertrained workers, or suboptimal workflows; 3) Technology Performance Analysis: Evaluating the current technologies and equipment used in the enterprise and comparing them to best practices in the industry. Consideration of automation and digitalization opportunities; 4) Methods of work: Review of existing methods of work in order to

optimize them. Implementing project management techniques, such as Agile or Scrum, to increase flexibility and responsiveness to change; 5) Innovation processes: Analysis of current innovation processes and their impact on production efficiency. Identification of opportunities for the implementation of new innovative projects; 6) Macroeconomic context: Consideration of external factors such as market trends, global challenges, and their impact on production processes; 7) Strategic Planning: Developing a long-term strategy for innovative development that includes investment in new technologies, staff training, and development of research and development activities.

This analysis will help identify key areas for innovation that can increase productivity, reduce costs, and improve product quality. It is also important to ensure that innovation efforts are in line with the strategic goals of the enterprise and the needs of the market.

The development of an innovation strategy based on the principles of Kaizen should include an action plan covering all stages from idea to implementation, with clear criteria for evaluating performance and feedback mechanisms. It requires a systematic approach that covers the following stages: 1) Defining the purpose of innovation: A clear understanding of what needs to be improved or solved through innovation. The goal should be specific, measurable, achievable, realistic, and time-bound (SMART); 2) Analysis of the current state: Conducting diagnostics of production processes to identify bottlenecks and opportunities for improvement. Using quality tools such as 5 Whys or Ishikawa Diagram to identify the causes of problems; 3) Development of an action plan: Creating a detailed plan that includes the steps of implementing innovations, responsible persons, resources, timelines, and expected results. The plan must be flexible to adapt to changes in the implementation process; 4) Innovation: Implementation of the Innovation Action Plan. Involving all stakeholders and providing training and support to staff; 5) Monitoring and evaluation: Establishing criteria for evaluating the effectiveness of innovations and regularly monitoring progress. Using KPIs and other metrics to measure the impact of innovation on production; 6) Feedback and Adjustments: Collecting feedback from

employees, customers, and other stakeholders. Analysis of the data obtained and making adjustments to the action plan for further improvement; 7) Standardization of successful practices: After confirming the effectiveness of innovations, standardizing new processes to ensure their continued use and improvement; 8) Kaizen and Continuous Improvement: Application of the PDCA (Plan-Do-Check-Act) cycle for continuous improvement and implementation of Kaizen culture in the enterprise. The strategy should be focused on the long term and involve all employees in the innovation process.

The result of the work is the conclusion that the introduction of innovations in heavy engineering, based on the principles of Kaizen, contributes to increasing productivity, efficiency and product quality. Continuous improvement and elimination of losses are key to achieving competitiveness and adapting to changing market conditions. Involving staff in the innovation process has proven to be effective in implementing change and maintaining a corporate culture of continuous improvement. Experimental implementation of innovations and their evaluation through pilot projects allows you to identify potential risks and improve innovations before large-scale implementation.

Prospects for further development in this direction include expanding the application of Kaizen to various aspects of production, including logistics, quality management and the work environment. Integrating digital technology and the Internet of Things (IoT) to collect data and automate processes for further improvement. Developing a culture of innovation among employees, stimulating creativity and initiative at all levels of the organization. Further research on the impact of Kaizen on economic efficiency and sustainability of production in response to global challenges. Development of universal methodologies for evaluating the effectiveness of innovations, which can be adapted for different industries.

Summary and conclusions.

As a result of the study, it was established that the kaizen philosophy is an effective tool for the implementation of technological innovations. Combining incremental improvements with systematic process analysis has been found to

minimize innovation risks and ensure continuous optimization. In addition, it was established that an important role in the success of the implementation of innovations is played by the involvement of personnel, the creation of a favorable organizational culture and the use of modern project management tools.

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