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PROCESSES ORGANIZATION FOR CREATING COMPETITIVE PRODUCTS AND PRODUCTION SERVICES OF AN INDUSTRIAL ENTERPRISE: MANAGEMENT PROBLEMS AND SOLUTIONS

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Abstract

This work has investigated analysis results of management problems and solutions to the processes organization for creating competitive products and production services of an industrial enterprise which were presented in the scientific reports of the section "Economics and organization of mechanical engineering production" of the All-Russian conference of young scientists and specialists (with international participation) titled "The future of mechanical engineering in Russia", held from September 22 to 25, 2020 at the BMSTU, substantiated the development relevance of scientific research specialty "Organization of production". This specialty includes the development of scientific, methodological, and system-technical foundations for the design of organizational structures of enterprises and organization of production processes. It also includes development of methods and means of informatization and computerization of production processes, their documentary support at all stages; development of scientific, methodological and system-technical principles for increasing the efficiency of the functioning and quality of the organization of production systems; improving the quality and competitiveness of products, quality control systems and product certification; development and implementation of the production management principles, including the training of personnel and the effectiveness of labor organization forms; analysis and synthesis of organizational and technical solutions; development of methods and tools for planning and managing production processes and their results. This work has been addressed to specialists in the field of theory and practice of organization of production

Keywords

Industry, enterprise, production, management problem, organizational and technical solution

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Introduction. The All-Russian conference of young scientists and specialists (with international participation) "The future of mechanical engineering in Russia" was held in the BMSTU from September 22 to 25, 2020 in full-time and remote formats. It was organized by the Mechanical Engineering Union of Russia and the BMSTU. The conference was devoted for discussing a wide range of issues related to the use of the latest achievements of science and practice in many fields. These fields include mechanical engineering, power engineering, special mechanical engineering, robotics and integrated automation, development of engineering education, economics and organization of mechanical engineering production, organizational support of scientific, and technical activities.

This work aims at presenting results of the management problems and solutions analysis to the processes organization for creating competitive products and production services of an industrial enterprise in scientific reports of the section "Economics and organization of mechanical engineering production" of the conference.

Results. An approach for implementing the concept of a digital twin [1] in mechanical engineering using decentralized data storage and smart contracts based on blockchain technology was proposed in [2]. The author has presented analysis results of the specifics and formulated the basic requirements for digital twins of mechanical engineering products and their production processes.

Main trends in video surveillance development, video analytics technologies, and their prospects for application in the processes of creating competitive products and production services of an industrial enterprise were identified in [3]. The authors have systematized the sources of economic effects from the introduction of video surveillance technologies and video analytics into industrial enterprise production processes.

Main trends in developing resource management systems for industrial enterprises [4] and the reasons for the growth in the need for implementing them were identified in [5]. The author has presented analysis results of the advantages and disadvantages in making organizational and technical decisions on the implementation of resource management systems for an industrial enterprise. The author has concluded that the feature of these decisions is formation of an optimal set of key performance indicators of the enterprise [6–8].

Strategy analysis results for the development of technological and innovative activities in the nuclear industry were presented in [9]. The author has identified promising directions for the development of production facilities in the ROSATOM. The author has also proposed an approach for assessing their current technical condition based on an assessment of the armament, quality

of fixed assets, performance efficiency, and the sequence of development of the scientific and technological apparatus of production.

Results of modeling the formation of a production function which makes it possible to assess the contribution of process capital [10, 11] in creating the value of a mechanical engineering enterprise were presented in [12]. The authors considered a static version of the function which reflects the relationship between economic indicators and analysis results of the various factors influence on the production output volume, work performance, and the production services provision of a mechanical engineering enterprise at a certain point of time.

The results of modeling the optimal structure of resources to support management processes for development, production, after-sales services, including the supply of spare parts and equipment, Sukhoi Company based on forecasting models [13] were presented in [14]. The authors have modeled the interchangeability of resources based on the production function formation [15] and the optimization of their purchase. Distribution is the result of solving linear programming problems.

The dynamic changes visualization technology, in the microeconomic system internal parameters of a mechanical engineering enterprise for a certain period of time in the form of multidimensional pictographs based on Chernoff faces [16, 17], was developed and presented in [18]. The authors have used the environment of the STATISTICA package (developed by StatSoft) as a modeling environment for Chernoff faces in which it is possible to build fully parameterized multidimensional pictographs.

Environmental aspects identification is one of the necessary stages of the management process for the implementation of an environmental management system at a modern industrial enterprise [19, 20]. The term "environmental aspects of an industrial enterprise" in [21] is defined as "elements of an organization's activities, products, works and (or) services that interact" or can interact with the environment causing environmental impact. These impacts can be unfavorable or favorable bringing both risks and opportunities. The author proposed carrying out the identification of environmental aspects at the stage of strategic planning of innovative and supply-production, and marketing activities of an industrial enterprise when its management forms an environmental policy and defines the goals and objectives of the organization. The author has also proposed using data mining methods [22].

The planning processes system for implementing an innovative project in a project-oriented organization, which can improve the efficiency of solving the organization's problems and achieving the goal of its main activities, was presented in [23]. The author, based on the analysis results of Russian and foreign

scientists and specialists' publications in the field of project management, modeling and optimization of organizational structures and production processes, has developed an algorithm for the implementation of a planning processes system. The main purpose was implementing an innovative project in a project-oriented organization [24–27]. This algorithm consists of four stages:

1) selection of an innovative project in the initiation phase of planning processes system implementation where this system is to be implemented in an organization. Manager of the selected project monitors and analyzes the management processes for project implementation based on a balanced scorecard;

2) evaluating the effectiveness and efficiency of the completed innovative project in the organization;

3) improving the system of planning processes for implementing an innovative project in an organization. This is to be done with adjusting the requirements and conditions for changing its content, report templates for various types of communications between stakeholders and a system of indicators for assessment of the project and (or) system processes;

4) making a decision, by the head of the organization, on the use of the planning processes system for their implementation by the leaders of innovative projects.

Process features analysis results of industrial enterprises digital transformation were presented in [28]. The author has developed an algorithm for calculating the digitalization level of an industrial enterprise. This algorithm is based on the enterprise structure into functional areas "design", "production", "internal logistics", "external logistics", "management", selection, and justification of the estimated indicators of the organization digitalization level [29] and the application of the deterministic integrated assessment method [30].

Main trends in the development of machine learning technologies and their prospects for application in the processes for creating competitive products and production services of an industrial enterprise were identified in [31]. The authors have proposed an approach for solving the problem of increasing the efficiency of enterprise processes based on the development of their digital twins. This can allow the use of calculation algorithms within one program and provide information in the real time [32].

Analysis results of management problems and organizational and technical solutions of the industrial enterprises management based on blockchain technology and artificial intelligence were presented in [33]. The authors have identified the advantages and disadvantages of these solutions. They also concluded that their implementation opens up opportunities for the development of organizational and managerial methods and organizational and functional models

for increasing the efficiency of the functioning of industrial enterprises and algorithms for managing the informatization and computerization of organizational processes and their documentary support at all stages. Using blockchain and artificial intelligence technologies, participants in the processes of creating competitive products and manufacturing services can confirm transactions without the need for a third party. Moreover; they can reduce costs, increase speed and reach, and also increase transparency and traceability in industrial supply chains and their management processes [34–36].

Decomposition of managerial, organizational, and technical decisions by the functions of a mechanical engineering enterprise was studied in [37]. The authors have developed an analysis method to study the compatibility of individual solutions for significant functions of the enterprise and solutions within the framework of their implementation. This makes it possible to substantiate alternative options for the direction of the organization development. This method consists of three stages:

1) selection of significant functions taking into account the characteristics of the mechanical engineering enterprise;

2) research of managerial decisions on the selected functions based on the morphological box method [38];

3) calculating the estimated indicators and choosing direction variant of the development of a mechanical engineering enterprise.

The method has been applied at a full-cycle enterprise that carries out operations from procurement procedures and resources storage to the transfer of products to the customer.

The new design and rationalization of the existing organizational structures of a mechanical engineering enterprise management is possible only on a strictly scientific methodological basis. It is a system of principles for the formation of management organizational structures [39]. Comparative analysis results of methods for designing organizational structures of a mechanical engineering enterprise management and the system of their principles, as well as an approach to their implementation were presented in [40]. The authors have proposed a sequence of stages for designing an effective management process for a mechanical engineering enterprise based on substantiating the parameters of modeling its organizational structure. Theses stages can be listed as follows:

1) determination of the composition and content of enterprise management functions;

2) calculation of the employees' number in enterprise management for each of its functions;

3) determining the number of structural divisions of an enterprise based on control standards;

4) determining the number of management levels taking into account the average control rate for heads of enterprise departments;

5) distribution of the enterprise employees according to the established levels of management ensuring a rational degree of management centralization;

6) enterprise management approval of changes in the regulations on structural divisions and job descriptions for employees.

Conclusion. This work has studied the management problems and solutions to the processes organization for creating competitive products and production services of an industrial enterprise which were presented in the scientific reports of the section "Economics and organization of mechanical engineering production" of the All-Russian conference of young scientists and specialists (with international participation) "The future of mechanical engineering in Russia". This conference included the following research areas of the specialty "Organization of production": development of scientific, methodological, and system-technical foundations for the design of organizational structures of enterprises and organization of production processes; development of methods and means of informatization and computerization of production processes, their documentary support at all stages; development of scientific, methodological and system-technical principles for increasing the efficiency of the functioning and quality of the organization of production systems; improving the quality and competitiveness of products, quality control systems and product certification; development and implementation of the production management principles, including the training of personnel and the effectiveness of labor organization forms; analysis and synthesis of organizational and technical solutions; development of methods and tools for planning and managing production processes and their results.

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