Main approaches to the development of mechanical engineering as an echelon of economic dynamics

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Abstract. In the present article the specificity and basic directions of development of domestic mechanical engineering are considered. The optimality of a choice of progressive system of maintenance including procedures of fast management of manufacture of production, allowing raising efficiency of administrative and financial work at the enterprise, and also competitiveness of let out production is proved. This allows improving the organizational and economic model of operational production management, focused on improving the competitiveness of the machine-building enterprise products.

1. Introduction

As a retrospective analysis, we note that the process of reforming the Russian economy, which led to its openness and restructuring with the liquidation of many industries, was accompanied by a number of emerging, but weak incentives for increased innovation. However, as many experts and specialists admit, the Russian economy still cannot accept innovations, in particular product ones, without significant positive changes in the innovation sphere [1].

At the same time, industrial innovations are the most valuable element of modern society, ensuring economic growth, further improving the living standards of the population and increasing the country's competitiveness and security. In addition, we are talking about a new industrial revolution, a re-industrialization of the economy based on high science-intensive technologies and industrial application of new scientific and technological achievements, that is, on the basis of constant innovations in industry and the economy as a whole [2].

This is the activity of industrial enterprises, which allows us to transform R&D results into new technologies and products.

When building an industrial-innovative process, we can use the traditional linear model, which includes: applied research - development - preparation of production - market research - commercial production; or a non-linear model, in which we can recreate the innovation process [3].

In modern conditions of growing environmental uncertainty, the various stages of the innovation process associated with the orientation to the innovation market, as well as the direction of solving problems and meeting the needs of potential buyers, are of particular importance [4].

Another important aspect of the organization of the innovative process of an enterprise is the assessment of its innovative potential, which largely depends on the company's strategy, management structure, business culture and resources, including technological assets, key competencies, etc. [5].

Since it is believed that the innovation strategy should organically be combined with the general strategy of the company and its functional strategies in marketing, finance and production, it is necessary...
to debug the mechanism of transformation of the strategic goals of the company to achieve its goals and plan innovative activities [6].

Each company develops its own mechanism for the search and implementation of scientific and technical ideas, taking into account the specifics of its activities. It is generally recognized that the development of an innovative strategy is a complex and multifaceted activity that requires the same careful and balanced approach as the overall strategy of the enterprise. At the same time, the main goal of the innovation strategy is to ensure the potential profitability of the organization in the future [7].

A good innovation strategy is the result of an analysis of the relationship between different groups of factors. These include trends in the external business environment and data on the internal environment of the organization, goals and strategies of the enterprise, as well as the R&D budget [5].

The defining vector in the process of developing a strategy for innovative development of an enterprise is its corporate strategy, which defines the goals and directions of development of all the main areas of economic activity, including research and development. When forming the strategy of innovative development of the enterprise, the determining factor is the company's desire to become a leader or follower in the field of technology. Companies seeking to become technology leaders or consolidate their leadership must, of course, adhere to an offensive strategy. He must keep an eye on the market and technological prospects and quickly turn them into new products [8].

2. Theoretical basis

Nowadays, in the context of worsening geopolitical and economic processes, the scientific community and production management are actively looking for ways to most effectively enter the competitive environment of engineering enterprises [9], [10].

The risk of this situation increases due to a significant narrowing in these conditions of a number of positive aspects of the industrial development of the country as a whole achieved over the past decade, which can lead to stagnation and crisis in the state and regional sectors of the production of materials, which will undoubtedly exacerbate the accumulated social problems [4].

At the same time, the competitive environment opens up additional opportunities for ensuring the quality and price competitiveness of Russian engineering products on the world market.

The realization of these opportunities requires flexibility and efficiency of management systems of machine-building enterprises, the advanced experience of the used tools, methods and mechanisms, and commensurate with international counterparts [11].

When it is expected that some machine-building enterprises and material production sectors will face significant risks and dangers, the flexibility of quick production management can become the basis for achieving the desired level of competitiveness and product quality in the face of possible fluctuations and changes in external and internal environmental factors.

One of the tools to ensure the competitiveness of enterprise products may be the introduction of an internal control system for managing external and internal risks that combines OLAP. This allows to constantly monitor several types of risks, such as currency risk, product price risk, interest rate risk, etc. in order to minimize its impact. This ensures that the existing pricing policy of the company is adjusted when making settlements with counterparties, overcoming the uncertainty caused by changes in the market and exchange rate, and also when implementing measures to increase the efficiency of production activities with the involvement of identified potential and resources. One of such events is the selection of optimal information technology (IT) support, which will increase the efficiency of operational management of the production of competitive products [12], [13].

2.1. Analysis of factors of the external and internal environment

OLAP technology allows to identify and justify the prerequisites for the implementation of IT systems, as well as to identify the goals and objectives of the project.

Under the general approach to the interpretation of the term “concept” in economic theory, it is understood as a management process that defines goals and objectives, principles and forms, as well as methods and tools for system-wide development related to functions that are formed as a result [14], [15].
Thus, the prerequisites for the implementation of an enterprise management ERP system are determined by factors of the external and internal environment:

- realities of the geopolitical situation and the need for import substitution in the machine-building complex in the Russian Federation;
- experience of successful application in the industrial sector of the country;
- compliance with modern functional and technical requirements of analogues of this category, as well as Russian and international corporate governance standards;
- growing production and sales plan;
- need to improve the quality and effectiveness of planning at the level of functional subsystems of elements (workshops);
- requirement of operational control of computer numerical control (CNC) machines;
- modern production management requires the operator of the receiver, maintenance of the workshop (planning and dispatch bureau (PDB); bureau of instrumental economy (BIE)) and the results of monitoring the operation of the equipment;
- compliance with the professionalism of management personnel;
- understanding of management and middle managers, as well as in addition, the need for implementation in production personnel;
- provision of necessary material resources;
- level of implementation of IT infrastructure at the enterprise.

The main tasks of the development and implementation of a progressive information management system are shown in the figure 1.

![Figure 1. Objectives of introducing a progressive information system.](image-url)
3. Methodology

The methodological basis of the study is the work of domestic and foreign scientists and economists on various aspects of this issue in the production management system of Corporate Information System (CIS) M-3.

Implementation of the CIS M-3 production management system (integrated enterprise information system for managing the activities of industrial enterprise units with a large amount of equipment and repair work), built on client-server technology, includes the following modules: production management, logistics, finance and economics, strategic planning and change management. This system can increase the efficiency and effectiveness of the main and auxiliary units of a machine-building enterprise due to better and more detailed planning, organization and management of production processes, accounting and control [16].

IT system CIS M-3 with automated system for design and technological preparation of production (AS DTPP) and automated system of financial and economic management system based on the budgeting and financial flow control system (AS FEMS), delivered in an automated mode, includes business production management, determination of the need for materials and components, quality management, accounting of finished products, costs and invoicing.

It is important to highlight that, when choosing the composition of CIS and the sequence of implementation of its subsystems, questions of evaluating the functions that will be in demand by business should be considered. If you plan to automate only finances, personnel and sales, then there is probably no reason to pay for all the various functions of CIS.

Continuing the topic of participation in the selection of information systems for business for specialists of companies that do not have experience in the field of information technology, the article provides a brief description of the goals of the main blocks of a modern integrated information system (CIS). The functions of CIS are indicated by a large number of special terms and abbreviations. Most of them were somehow solved, but there are new combinations. Software vendors sometimes use the same terms for software products where complexity and depth are not completely equivalent. The names of some functional modules that have appeared recently usually coincide with the names of modern corporate governance concepts, but even in this case, it is necessary to carefully monitor the correspondence between the functional content of the business concept and the content that you want to sell under the same name. A significant part of the CIS functions is simply not suitable for unification (not to mention the development of standards), so it is better to spend some time to ensure that the proposed solutions are complete.

The introduction of AS DTPP:

- improves transparency and controllability of pre-production processes;
- reduces production time (both the period for the development of new products and modifications to existing ones);
- increases the assessment of the effectiveness of employees involved in the design and technological preparation of production;
- increases the accuracy of the data for the order of purchased components and materials;
- improves the quality of technical solutions and reduces the time of preparation and design of technical documentation;
- reduces the costs of product development and improves the quality and flexibility of design processes;
- improves consumer characteristics of products sold.

4. Results

Figure 2 shows the scheme of the system of operational management of the machine-building enterprise production.

Interaction of software products provides continuous reading of information about operation and maintenance of equipment, the formation of control reports on the facts of production tasks in online mode, resource planning and technological process. The advantage of the system is its continuity with national specifics and traditions of operational production management. In particular, the system carries
out designing of replaceable works, provides administration and synchronization of corporate databases, and also transfer the design and technical documentation to users.

![Diagram of IT support systems for production management]

**Figure 2.** System landscape of IT support for the production management of machine-building enterprise.

In addition, the following functions can be attributed to the advantages of IT systems for quick management of production activities:

- use of alternative production routes;
- formation of one-time production orders;
- user-view design and technical documentation in 2D and 3D models;
- monitoring of processes and operations of personnel, technological equipment necessary for their implementation; automatic notification of the occurrence of specific malfunctions of technological equipment, problems with control procedures and technical means and absence of the necessary technical equipment for the corresponding competent maintenance of a machine-building enterprise.

5. **Discussion**

The choice of the optimal model, the rational positioning of the operational management and its IT support are key factors in increasing the competitiveness of products and businesses in a market environment.

Successful adaptation to new conditions and factors of the competitive environment sets itself the task of improving all types of organizational and managerial activities, including managing the
manufacturing business as a separate segment of a machine-building enterprise, and coordinating actions for the rational distribution of available resources in accordance with strategic development goals.

The need to clarify the methodological basis for the formation of an updated conceptual approach to creating an organizational and economic model for the operational management of the production of competitive products has led to the addition of a classification apparatus.

Figure 3 shows a conceptual diagram of the organization of operational production management at the workshop level of a machine-building enterprise using an integrated IT system.

It should be noted that the proposed production planning concept based on the configuration of the integrated enterprise management system provides optimization of business management and the main aspects of the organization of production of competitive products disclosed in this clause, and this scheme allows us to include not only ERP systems, but also their modern analogues, which makes it universal. Its diversity will depend on the specifics of the organization of production at machine-building enterprises, methodological safety and the practical readiness of managerial and production personnel for implementation, the existing organization and distribution of labor and responsibility for functions, as well as the production capacities, technologies and equipment use.

![Conceptual diagram of operational production management](image)

Figure 3. Conceptual scheme of operational production management.

6. Conclusions
The purpose of the study was the justification and development of theoretical and methodological provisions, as well as practical recommendations for the rapid management of the production of competitive products in machine-building enterprises.

The main results of this study and its conclusions and recommendations are to determine the methodological components of the operational management of machine-building enterprises.

On the basis of the analysis of modern concepts, interrelations with the implementation of long-term and medium-term perspectives were revealed, which are integrated into specific and system-wide functions that meet the objectives of competitive product manufacturing, and are positioned in the organizational and economic processes of operational management.
With the development of socio-productive relations, the division and concentration of capital, the industrialization and scientific and technical progress, the distribution of productivity of scientific ideas for effective management of technological processes in organizational-economic, the temporal and spatial perspective and scientific ideas about effective management of technological processes have been accumulated and deepened.

Currently, the quick management system meets the challenges of producing competitive products and is associated with the implementation of long-term and medium-term prospects, goals and directions of development of engineering enterprises.

The methodological component of the modern concept of the organization of operational production management at machine-building enterprises is its purpose in accordance with the criteria for minimizing quantity, time, quality and material costs, as well as control over their implementation among the performers.

In accordance with the theoretical and practical approaches discussed in the article, rapid management is a system of specific procedures in which the object is a production process, the subject of which is a set of tools, methods, relationships, private and system-wide functions of a group of multilevel production units of a machine-building enterprise.

The management of domestic engineering enterprises, as a rule, is based on the provisions formed in the Soviet era, when the management of domestic production activities was considered abroad from time to time, without proper theoretical understanding and practice. In fact, the management process at that time was reduced to a planning function, which included the development of a schedule for each department, setting planned tasks in time and space, as well as monitoring the movement of products within the plant and, as a rule, without a system-wide integrated direct management production process.

In the new economic conditions, the need for an analysis of modern concepts of production management related to the goals and objectives of the operational management of the production of competing products at machine-building enterprises of Russia is being updated.

It can be said that the existing experience in managing production at machine-building enterprises is based on the experience of centralized economic management and reflects planning and organization processes at the state and industry levels. It also explains the shortcomings of modern management: the secondary nature of analysis and foresight, development strategies and evaluation of competitive factors.

Features and relationships of the business management system used and implemented in domestic practice are formed and determined by the organizational, economic and technological features of engineering enterprises.

Thus, the results obtained indicate that one of the effective reserves to increase the competitiveness of enterprises in the engineering industry of the regions and the country as a whole is to increase the effectiveness of operational management of modern production.

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