

Operational Production Management Model of Competitive Products in Mechanical Engineering

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Abstract – There is an improvement of the organizational and economic model of operational management of the production of competitive products, which combines and discloses the systematic use of interconnected key principles, methods, tools, forms and processes of operational management in the implementation of production tasks of a machine-building enterprise.

Keywords – engineering enterprises, operational management, organizational and economic model, product competitiveness.

1. Introduction

The spacetime implementation of the operational management of the production of competitive products at a machine-building enterprise, depending on the type of it, is determined by technological and resource capabilities, development directions in achieving the production of a strategic range of competitive products, and the demand and supply of markets.

In the context of aggravation of geopolitical processes and the economic environment, problems identified during the analysis of external and internal factors and the search for alternative solutions in the

process of managing economic activity become especially significant for the competitiveness of products of a machine-building enterprise [7].

At the same time, modern practical solutions demonstrate that the costs of organizing and implementing production management are constantly increasing, and the consequences of unjustified management decisions become more difficult.

Developing competitive relations affecting the efficiency of production activities of machine-building enterprises, need the resolution of the problems of organizing successful interaction of operational production management at the level of subsystem functional elements (shop floors, sections) with a common integrated management system, as the most important condition for ensuring the competitiveness of products [3], [17].

2. Theoretical Basis

A.N. Pytkin substantiates that, within the framework of systemic unity, long-term and operational management should be independent. Since decisions worked out at a strategic level cannot always be optimal, due to the fact that the decision maker (DM) does not have the capacity to plan all development options, and operational management allows for adjustment procedures to be implemented for long-term and medium-term production plans at appropriate times and within the limits of existing authority [8].

In this case, the interaction of long-term and operational management should be complex, it should have feedback that allows to respond to information from the other side, including not only changes in the external environment, but also to each other's new quality, that is, provide opportunities for improvement.

The optimality of the interaction of long-term and operational management is ensured by the timeliness, reliability and quality of management decisions [16].

The analysis and research of the features of the organization of operational production management for some machine-building enterprises helped to identify and highlight a number of existing

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shortcomings, which have a significant impact on the competitiveness of products and business entities.

Among them there are:

- non-optimal distribution of production plans between shop floors, sections;
- duplication in the definition of shift-daily tasks;
- untimely adjustment of the regulatory framework and calendar planning standards;
- lack of proper control over observance of schedules for providing jobs with materials, blanks, tools and equipment;
- non-observance of terms and volumes of parts, products during intershop floor movement;
- untimely adoption of managerial decisions on the problems encountered

(marriage, violation of completeness, technology, untimely delivery, etc.).

3. Methodology

For optimal resolution of the indicated problems, we propose improved organizational and economic model for the operational management of the production of competitive products, which combines and discloses the systematic use of interconnected key principles, methods, tools, forms and processes of operational management in the implementation of the production tasks of a machine-building enterprise. In view of the significant number of subsystem elements, the structure of the organizational and economic model is presented in Figure 1.

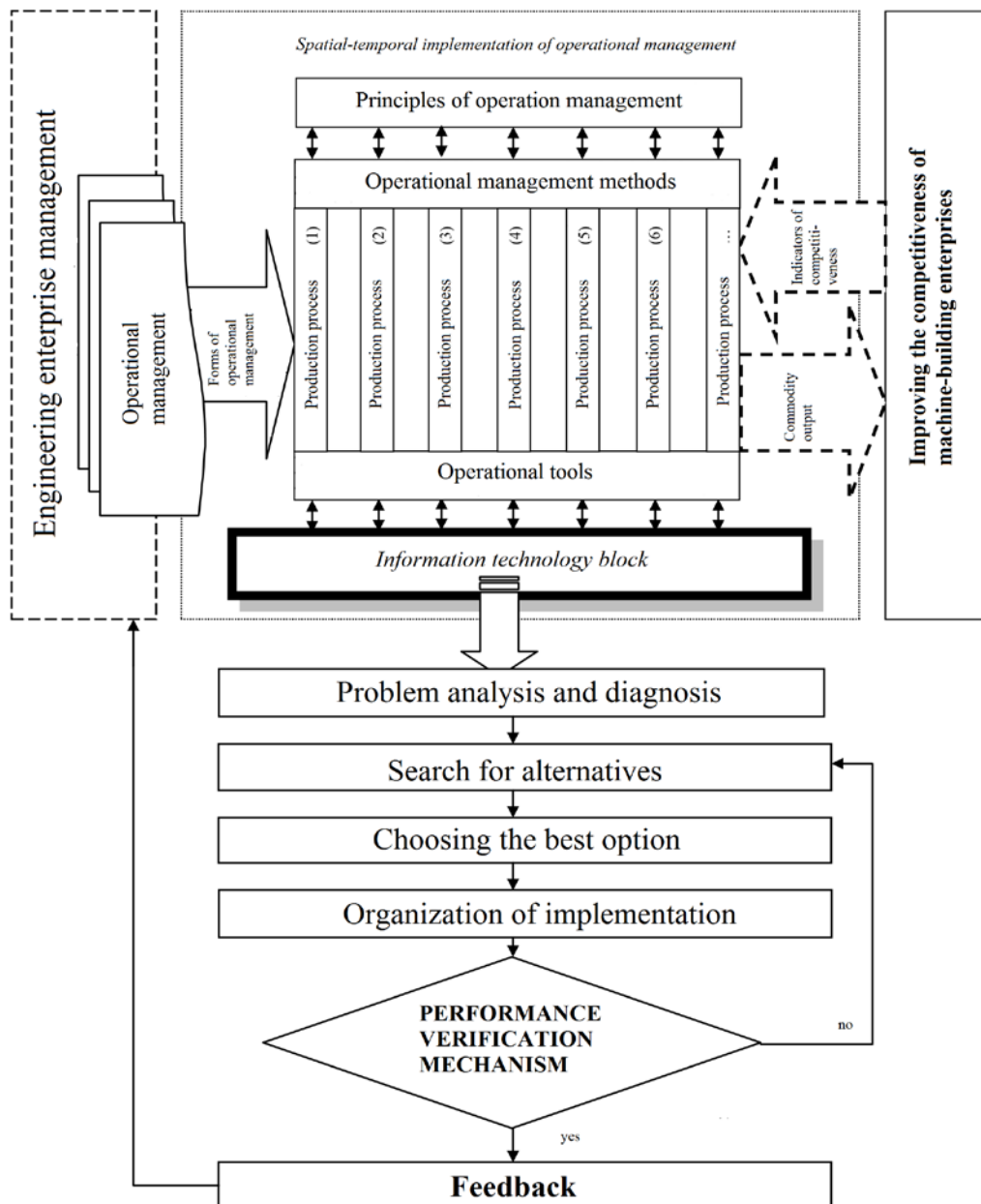


Figure 1. Improved organizational and economic model for the operational management for machine-building enterprises

In the modern economy, modelling is an integral element of the theory and practice of implementing system-wide management approaches. It has features and advantages, the manager is able to depict and present the image of any spacetime form of the state of the system both in the past and present, and in the desired vision, as well as reflect the properties and patterns under study using them [10]. Through modelling, an in-depth study of the qualitative and quantitative correlations of elements is provided, the idea of their relationships is formed [4], [5].

The model should reflect the most significant parameters characterizing the object of modelling, and when constructing it, it is necessary to determine the composition of the factors that have the most significant influence on the object of study [9], [14]. At the same time, proportionality in the number of these factors should be observed, their large number complicates the model, increases the complexity of its implementation, their small amount will not allow to fully describe and study the investigated and implemented processes.

In this regard, the optimal selection of factors and their values allows us to develop a multicriteria model that contributes to a systematic study of phenomena, the identification of inter-element relationships and the effective resolution of problems.

The improved model reflects the organizational and economic construction of the machine-building enterprise management system and the construction of processes for spacetime implementation of the operational management of the production of competitive products in it, demonstrates and characterizes a significant number of elements and the relationships between them. Due to the complexity of the system under consideration, the construction of the model, in our opinion, must be carried out in a natural (non-mathematical) format [19].

The improved organizational and economic model for the operational management of the production of competitive products includes two segments: organizational and economic and algorithmic, which determines the functioning of the unit of information technologies (IT).

Within the first segment, a set of organizational relations arising in the management system of a machine-building enterprise, the spacetime implementation of the operational management of production and the release of commodity (finished) products as part of the implementation of the tasks of increasing competitiveness in the market is determined [11], [20].

The second segment is the algorithm that determines the functioning of the IT block, allows for

the calendar-functional decomposition of the production program in such areas as logistics, resources, technological capacity and equipment, by developing and approving shift-daily tasks, increasing coordination of participants in production processes, scheduling, control, analysis of problems, diagnostics of efficiency and conformity of quality of commodity (finished) products to competitiveness indicators [2], [25].

In this regard, there is the need for the formation and maintenance of an information basis (registration and movement of accounting information, its storage and accumulation in distribution and integrated databases) based on the collection of operational accounting data that allows for feedback (adjustment) of production tasks and plans [12], [21].

When improving the model, we should consider the need of specifics of the operational management of production, its place and interaction with the integrated management system of a machine-building enterprise, for example:

- acting as an integral part of the management of a machine-building enterprise, the operational management of production at the level of functional subsystem elements (shop floors) should have local independence. Decisions made at the highest system-hierarchical level of management and enlarged planning tasks are not always optimal and concretized to a lower level, since the range of their functional decisions does not provide for possible situations and deviations that arise in production activities and the choice of methods and sequence of implementation of production processes for the production of goods. Operational management at the level of shop floor should be able to make the necessary adjustments to current plans within the framework of the authority [1], [24];
- interaction of the operational management of production with the implementation of measures to increase the competitiveness of products should be mutual, have feedbacks that provide an opportunity to accordingly respond to information received from other subsystem elements and senior management based on the analysis of the achievement of certain and approved indicators of competitiveness. Such a mutual reaction allows us to develop methods and ways of adjustments in subsequent time horizons of management that provide adaptability, both operational management and system-wide management to changes in external and internal environmental factors, as well as to the updated state of each other [23];
- system-wide management of a machine-building enterprise, operational management of

production and the implementation of tasks to increase the competitiveness of products should be integrated with appropriate technical and software tools for corporate IT support, which allow for the uninterrupted and timely receipt of information about economic activity, progress of production processes and achievement of planned indicators;

- organization of the project management office (PMO) is based on methodological content, including selected forms, accepted principles and methods of operational management, as well as tools to implement a set of necessary production processes for the production of commodity (intermediate) products. The combination of these elements forms the corresponding field of the spacetime implementation of operational management (specific shop floors, sections, brigades, jobs and calendar periods: year, quarter, month, decade, week, shift, hour) [13];
- PMO engineering company is based on technologies for the development of managerial decisions aimed at achieving long-term competitive prospects on the basis of automated continuous analysis of possible changes in the influences of external and internal factors and emerging problems. These technologies are based on principles that allow the search for alternatives, the selection of the best option and the organization of its solution;
- PMO organization by a machine-building enterprise should include a mechanism for checking effectiveness and feedback according to the appropriate accepted algorithm [26].

4. Results

Improvement of the current organizational and economic model based on the proposed concept of improving the operational management of the production of competitive products at a machine-building enterprise was carried out on the basis of studies of the current state of economic activity, specifics of production processes and relations, existing and operated production facilities and equipment, organizational and functional management structure, and professional qualities and production motivation staff, etc [22], [27].

When introducing the model, the optimization of the production structure of a machine-building enterprise should be carried out. Thus, the adoption of an improvement in the organizational and economic model in a number of machine-building plants is based on the structural restructuring of enterprises over the past decade, creation of a new infrastructure (local-area channels, virtualization), organization of a training centre, implementation of Computer-aided design software "Compass-3D" and

Technological processes "Vertical", formation of an electronic archive of design and technological documentation in the system LOTSMAN: PLM and corporate reference databases, their synchronization with the databases of other companies of the group. User business processes are reflected in the PDM system, etc.

The task of constructing an organizational and economic model stems from the need to eliminate existing shortcomings in the framework of the concept of improving operational production management.

The above-mentioned tasks of building interactions between the PMO and the control system make it possible to define building links with the implementation of the competitive strategy of the machine-building enterprise as one of the main directions of these changes [6], [18].

5. Discussion

Implementation of the competitive strategy programmatically is the most important condition for optimizing and improving enterprise management today. The absence of this strategy leads to unsystematic defragmentation of management actions in the competition, does not allow an objective assessment of the effects of environmental factors and their risks, and limits the search and use of internal reserves and enterprise potentials. Moreover, the competitive strategy should not exist separately, in isolation from current production tasks and their operational management [15].

The competitiveness indicators from the strategy when implementing the model become the targets for both the management system of the machine-building enterprise and the spacetime implementation of the operational management of the production.

Another important direction in achieving product competitiveness is to increase the scientific feasibility of management, the essence of which is the development and application of advanced tools and methods, improving the regulatory framework and improving the quality of the professional level of managers and production personnel. The operational management of production has scientific and practical approaches based on progressive IT systems, identified in the model as a block of information technology and operational management tools. In addition, IT-technologies and their practical application are presented by the author as the most important element in achieving the desired efficiency of production activities. An equally important advantage of integrating a software product is the unification of internal factory electronic document management, which, based on local regulation, ensures clarity of production task formulations, reduction of excessive duplication, etc.

6. Conclusion

Thus, the improved organizational and economic model for the operational management of the production of competitive products is a combination of segments that provide targeted interaction between system-wide and operational management of production in the course of achieving a system-wide increase in competitiveness.

In this model, the coordination of the desired interactions is achieved by determining the necessary set of principles, methods and tools that form the operational management of production processes using implemented advanced IT tools and technologies.

The improved model sets up the operational management of the production activities of the main, auxiliary and service units to achieve the specified criteria for the competitiveness of products in terms of volume, timing, quality and level of costs.

The feature of the improved model is the inclusion of the IT unit that automates the management of production processes through the appropriate hardware and software tools according to the parameters disclosed in the dissertation research:

- planning and accounting unit (in machine-building production it is a part, unit, assembly, set, etc.;
- spatial horizon of operational management technological operation, workplace, team, site, workshop, production, enterprise;
- time horizon of operational management (shift, day, reporting period).

The introduction of an improved organizational and economic model for the operational management of the production of competitive products at a machine-building enterprise is a stage in the implementation of the conceptual approach.

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