RELEVANCE OF METHODS MATHEMATICAL MODELING OF MANAGEMENT THE QUALITY OF THE PRODUCTION OF AVIATION AND ROCKET AND SPACE TECHNOLOGY

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Introduction. The aircraft industry is one of the most high-tech and priority areas in terms of innovative development of industrial sectors of the national economy of our country today. This factor is large because in the modern world there are deep and wide-spread processes of changing the world economy and intensifying competition for sales markets, including high-tech products.

Methododolgy and literature review. The technological component of aviation and rocket and space technology is developing quite dynamically, regularly replenished with new samples of products, sometimes not having access to "open" printing. Some of them lose their relevance and role before they have time to be realized, while others become breakthrough tools for creating aviation and rocket and space technology of the future, and also find wide application in the national economy. Thus the aviation and rocket and space industry, being the driver of the development of the country's economy, continues to be the most technologically advanced and intensively developing sector of the economy, to increase the efficiency and rationality of the processes performed in which it is necessary to introduce a modern quality management system (QMS) based on the most innovative control methods to date [Bulletin of the ISH FEFU. 2016. P. 143-148]. Modern management currently, as noted above, widely uses mathematical apparatus to analyze possible behavior strategies, support decision-making, study graphs of various dependencies, statistical data processing, and computer modeling of processes. Modeling is understood as the study of the properties of the system using the constructed model. In practice, the following types of mathematical models are often used:

- analytical, which is a set of analytical expressions and dependencies;
- simulation, which is based on a computer experiment; Numerical, which is presented in the form of numerical methods and schemes that provide an approximate solution to the problem;
- algorithmic, which are represented by algorithms in the form of a certain logical sequence of operations performed on a computer.

However, this approach has certain disadvantages, in particular:

- unreliable initial assumptions – not all the prerequisites that are the basis of the model can be evaluated and verified.

- information limitations entail unreliability of assumptions and other difficulties in modeling since the accuracy of the model is always determined by the accuracy of preliminary information on an existing problem.

- fear of users – managers for whom models are created often do not understand result and therefore are afraid to apply them. There is no enough knowledge in this area.

- excessively high cost. It is necessary to estimate modeling costs in advance. Since models with excessively high costs are inefficient.

At the same time, the relevance of quality management in the production of aviation and rockets, and space technology lies not only in the presentation but also in the implementation of high requirements for the quality and reliability of this type of product. Modern aviation and rocket and space technology solve a huge number of strategic, both military and civilian tasks. Based on this, the reduction of defects and the exclusion of unusable machines and mechanisms is a strategically important task in modern aircraft and helicopter manufacturing enterprises, in the rocket and space industry [Vestnik VSTU, 2012, 34-39].

Analysis. The use of mathematical modeling for quality management has a significant advantage. In the theoretical field, modeling (especially the Monte Carlo method) is used if direct calculations in solving problems are impossible or time-consuming. Similarly, in the experimental field, modeling is used when experimental research is impossible or expensive. The advantage of modeling is that it allows you to get time- and cost-effective solutions, and also that in many cases it allows you to get solutions at all.

The benefit of using modeling in training to work with statistical data is obvious since modeling can effectively illustrate random changes. In addition, it should be noted that the current market economy imposes fundamentally new requirements on modern manufacturers of aviation and rocket and space technology regarding the quality of products. To a greater extent, this factor is because the success and profitability of modern factories depend on their stable position in the market, which, in turn, depend on the level of price and quality of products. Moreover, today it is the second factor that takes a higher priority place [Actual problems, 2017, 71-76].

Most modern aircraft manufacturing enterprises are based on process management of production. This type of management differs from the functional one in that the concept of «process» is defined as a sequence of actions aimed at achieving a final, measurable, and concrete result. For each of the sequential workflows, the management and control necessary to achieve the required level of quality of the manufactured equipment are carried out. Thus, production quality management has a particularly relevant role,

through which high efficiency and rationality of work should be achieved in aircraft, helicopter-building enterprises, and when creating rocket and space technology.

Studying statistical information concerning control and supervisory activities, it should be noted that the production quality management system at aircraft and helicopter manufacturing enterprises is imperfect and rather inefficient. This factor is proved by the high number of detected violations in technological processes and, as a result, accidents during real tests and during regular operation of equipment.

The combination of the presented factors determines the need for further improvement, including through the integration of innovative methods of production quality management in the field of aircraft and helicopter manufacturing enterprises. The key issue in this area related to the improvement of the quality management system is the optimization of enterprise planning and management. The solution to optimization issues based on the use and development of mathematical methods and digital technologies is the real and most effective tool necessary to further improve the work of aviation production units. It should be noted that the most relevant role of quality management and operational management of aviation production is precisely in the development and application of the integration of mathematical modeling methods. It is the mathematical apparatus that has the opportunity to provide the necessary tools, based on which the efficiency of the quality management system can be improved. As a result of the fulfillment of these tasks, satisfaction of the production of aviation and rocket and space technology should be achieved [Software products and systems. 2018. P. 39-45].

Thus, the processes taking place in the modern field of aviation construction require the application and use of information technology tools, one example of which is mathematical modeling and operations research through the use of highly efficient computer technology. Mathematical modeling consists in using the available data on certain characteristics of the expected object, processing them using mathematical methods, as well as obtaining a final dependence that combines these characteristics with time, and calculations of the found characteristics of the object at present. Mathematical methods include the use of modeling or extrapolation. Mathematical modeling has limitless possibilities aimed at the study of economic processes and optimization of management processses. To date, there are already developed universal methods and various modeling technologies designed to identify the most useful and rational mathematical model, the basis for the application of which is a wide class of phenomena and economic processes, in particular.

The models that exist today have high requirements. One example of these requirements is that the model should be of a simulation level so that the user can visually see and analyze the process being simulated on the screen of his electronic computer, as well as identify features or highlight statistics. In addition to all of the above,

mathematical models should comprehensively describe the process of reproduction of aviation and rocket and space technology. Models must have high detail, as well as high quantitative and spatial indicators. The developed models are required to provide a wide range of capabilities designed for their use to solve various tasks or simulate a wide range of production processes.

A mathematical model is a mathematical description of an ongoing process or object, the main purpose of which is its research or management. In the general interpretation, the model is a conditional image of the object of study, designed to simplify the analysis. When constructing mathematical models for quality control at aviation enterprises, it is assumed that its direct study can provide completely new knowledge about the object being modeled and the direct control of the functions or operations performed.

The integration of mathematical modeling methods when performing data analysis in production quality management systems is caused by the need to model the behavior of processes, manage their variability, as well as make informed management decisions based on measurements of the characteristics of processes and products. One of the priority tasks in quality control systems at aviation and rocket and space enterprises is to manage the variability of processes at all stages of the life cycle of equipment, starting with market research and design and ending with maintenance and disposal. In this regard, there is a need to process and analyze a large amount of data using mathematical methods. When analyzing data in quality management systems, statistical and computational methods are widely used, for example, approximate calculation of functions or solving optimization problems [Actual problems of aviation, 2020, 10-14].

The scientific novelty of the work lies in the fact that the author found out, that statistical methods are used in measuring, describing, analyzing, interpreting, and modeling the variability of quantitative characteristics of products and processes even in the presence of a relatively limited amount of data. Statistical analysis of this data can contribute to a better understanding of the nature, extent, and causes of variability. This can help in problem-solving, problem avoidance, and prediction of quantitative feature values. Computational methods are used in building models of process behavior, finding values of influencing parameters and solving optimization problems by reducing the problem to controlling simpler or more convenient characteristics, such as those whose properties are already known or easy to measure. Thus, methods of mathematical modeling allow better use of available data for making management decisions aimed at improving the quality of designed and developed equipment, reducing production cycle time, reducing losses in the production of products, as well as achieving customer satisfaction. Thus, the analysis showed that mathematical modeling of quality management is currently relevant for enterprises in aviation and rocket-space technology.

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To date, issues related to the development of a quality management system are becoming important in various industries. To a large extent, these issues are being updated due to the constantly increasing requirements for product quality, control, and efficiency of its reproduction. The study of these issues becomes particularly relevant when creating aviation and rocket and space technology, due to the great role of product quality in solving various military and civilian tasks. To analyze possible behavior strategies, support decision-making, study graphs of various dependencies, statistical data processing, and computer modeling of processes, modern management widely uses mathematical apparatus and innovative research methods, including mathematical modeling of quality management. In this article, an attempt is made to analyze the available innovative mathematical modeling methods for product quality management. In our opinion, mathematical modeling can become an important tool in solving many problems related to the quality management system. Thus, the main purpose of this article is to assess the relevance and role of mathematical modeling methods for product quality management in aviation and rocket and space technology. The work was carried out by analyzing the material available in the press concerning mathematical methods of modeling quality management about aviation and rocket and space technology.