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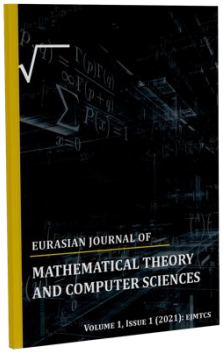


# METHODOLOGY FOR CALCULATING THE COSTS OF DEVELOPING, IMPLEMENTING AND OPERATING AN INFORMATION RESOURCE SYSTEM FOR MANAGING INDUSTRIAL ENTERPRISES

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**ABSTRACT**

*The modern world can be characterized by a time of increasing changes. The consequences of the scientific and technological revolution, expressed in the widespread use of advanced information technologies, have had an unprecedented impact on all spheres of human life. Perhaps the strongest consequences of such changes have been caused in modern business.*

*At present, drastic changes have taken place in the minds of managers. The number one priority is flexibility, focus on the consumer, creating a clear understanding of the ways of business development, quality and a global outlook. Flexibility refers to the search for undisclosed enterprise capabilities to adapt to the new realities of the external environment.*

*The relevance of the research topic is determined by two main points related to a qualitatively new state of the modern situation - the construction of an information society and the development of information technologies.*

*In the last decades of this century, humanity is moving into a new stage of its development - the era of building an information society. This type of civilization corresponds to the information technology revolution*

*currently taking place. During the formation of a new society, material production, worldview, way of life and education, art and culture undergo radical changes. Not only the forms, but also the content of the activity are changing. In this context, it is important to identify the new requirements imposed by the information society on enterprise management.*

**Introduction**

The appearance of the first management information systems dates back to the 1960s. They were the result of several factors: the development of computer and software technology, scientific research at leading universities and research centers, the increasing need to ensure the decision-making process for heads of organizations, the desire of managers to have a more adequate information picture of the activities of their enterprises, the increasing turbulence of the economic environment and increased competitive pressure. The following decades were characterized by an expansion of research in the field of information systems and an increasing number of organizations using such systems in practice.

In the course of their activities, managers in a modern organization deal with reality, which, from an information point of view, is characterized by an increasing amount of information coming both from the organization itself and from the external environment. The use of modern technical means of obtaining information has significantly increased the speed of information flows and their multi-channel nature. It can be assumed that in the future this process will develop exponentially. Another problem that managers face and attempt to solve it is the selection of the necessary information, the amount of which is reasonable for human capabilities, and on the other hand, sufficient to justify management decisions.

Inextricably linked to this is the desire to give information a structured appearance that allows it to transform its regulated information flows within the organization. Such information flows are supposed to be integrated into the daily activities of the enterprise, connected with the processes of designing the organization, its strategic management and issues of organizational culture. Thus, there is a need to create a system that ensures coordination and sets the directions for the dissemination of information in the enterprise; finally, such a system must quickly respond to emerging problems, i.e. deviations of the actual from the desired, which in modern conditions of increasing competition determines the achievement of success.

Among the main reasons for the growth of information in the industry, the following can be distinguished [4].

Firstly, the range of manufactured products is continuously expanding. Each product name requires the preparation of appropriate documentation (design, technological,

production, operational, etc.), the implementation of appropriate management tasks in the design, production, marketing and operation.

Secondly, there is a complication of machine designs and their production technology. Machines become structurally more complex, as automation elements appear and the number of components increases. More and more equipment is involved in the production of the same model every year. The greater the variety of technological processes, the greater the volume of relevant information, of course.

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Thirdly, under the influence of scientific and technological progress, the turnover of manufactured products is accelerating and innovations in the technology of manufactured products and the organization of production are more often carried out. As a result of these factors, production is being rebuilt more often, norms and regulations are being revised, and technical and structural policies are being adjusted.

Fourth, economic practice in the context of the transition to market relations puts forward qualitatively new management tasks, the solution of which requires studying information about the external and internal markets, sales and demand for manufactured products, information about the possibility of concluding contracts for the supply of components and materials, the availability of necessary raw materials in the markets.

**Research Methods**

The sources of economic efficiency arising from the use of computers in organizational management are: reducing the cost of processing a unit of information; improving the accuracy of calculations; increasing the speed of computing and printing work; the ability to simulate changes in some variables and analyze the results; the ability to automatically collect, memorize and accumulate disparate data; systematic database management; reducing the volume of stored information and cost of data storage; standardization of document management; a significant reduction in the search time for the necessary data; improved access to data archives; the possibility of using computer networks when accessing databases.

Requirements for the use of an information resource system for the management of industrial enterprises General requirements: Reliability and security: The system must ensure reliable and safe operation, protect data from unauthorized access and ensure their integrity. Scalability: The system must be able to handle large amounts of data and provide high performance. Ease of use: The system should be simple and easy to use, have an intuitive interface and provide quick access to the necessary information. Functional requirements: Data collection and analysis: The system should ensure the collection and analysis of production data, including data on productivity, quality and quantity of products. Production management: The system should provide production management, including planning, control and coordination of production processes. Warehouse management: The system should provide warehouse management, including inventory accounting and control, supply management and logistics. Personnel management: The system should provide personnel

management, including accounting and control of working hours, salary and personnel management. Reporting and analysis: The system should provide reporting and analysis, including the creation of reports on production, financial activities and other aspects of the enterprise.

Technical requirements:

Operating system: The system must be compatible with popular operating systems such as Windows, Linux and macOS.

Database: The system must use a reliable and scalable database such as MySQL or Oracle.

Software: The system must be written in modern software such as Java, Python or C#.

Interface: The system should have an intuitive and user-friendly interface that provides quick access to the necessary information.

Data security and protection:

Authentication and authorization: The system must provide authentication and authorization of users to prevent unauthorized access to data.

Encryption: The system must use encryption to protect data from unauthorized access.

Backup: The system must provide data backup to prevent data loss in the event of a failure or accident.

When analyzing the effectiveness of automatic control systems (ACS), it is important to take into account that the final effect of using a computer is associated not only with reimbursement of costs for the purchase, installation and operation of equipment, but, first of all, with an additional improvement in the quality of decisions made.

The economic efficiency of information processes is determined by the ratio of the costs of technical means and wages of employees with the results of their activities.

The economic efficiency of information processes is the degree to which information processes contribute to achieving the goals and objectives of an organization, while ensuring optimal use of resources and minimizing costs.

Factors affecting the economic efficiency of information processes:

Process automation: Automation of information processes can lead to reduced manual data processing costs and increased productivity.

Increased accuracy: The use of information systems can reduce errors and increase data accuracy, which can lead to reduced error correction costs.

Increased speed: The use of information systems can speed up the data processing process, which can lead to reduced time costs and increased productivity.

Increased accessibility: The use of information systems can provide access to data from anywhere and at any time, which can lead to a reduction in the cost of searching and obtaining information.

Methods for evaluating the economic efficiency of information processes:

ROI (Return on Investment) method: Assessment of the economic efficiency of information processes based on the ratio of information system costs and income received.

TCO (Total Cost of Ownership) method: An assessment of the economic efficiency of information processes based on the total cost of owning information systems, including procurement, operation and maintenance costs.

NPV (Net Present Value) method: Assessment of the economic efficiency of information processes based on the net present value of future revenues and costs.

There are a number of approaches to determining the main components of the effect of information activity. These concepts are based on the concepts of information products (various types of information), the information effect, the magnitude of loss prevention, the socially necessary level of awareness, and others.

Capital investments in the implementation of the proposed task or subsystem of the automated control system (K) are calculated if the implementation of the task entails the acquisition of additional technical means. Thus, the cost of implementing a computer network should be calculated using the following formula:

$$K = K_{ao} + K_{\text{по}} + K_{\text{пл}} + K_{\text{мн}} + K_{\text{пп}} \quad (1)$$

where $К_{ао}$ - hardware cost; $К_{по}$ - the cost of the software; $К_{пд}$ - the cost of additional space;
$К_{мн}$ - one-time costs for commissioning, installation and start-up; $К_{пп}$ - pre-production costs (for research and development work, preparation and development of production).

The costs of setting tasks that can be solved using All programming and implementation are determined based on expert assessments. Experts are specialists who create and operate information systems.

These costs are of a one-time nature and are taken into account together with additional capital costs when calculating efficiency.

The use of a computer network requires additional costs for its operation and maintenance. The cost of consumables when using a PC and peripheral equipment (purchase of paper and tape for the printer, flexible magnetic disks, cartridges for refilling the printer, etc.) compared with the cost of consumables when solving tasks manually, as evidenced by expert data, even increases by about 5%.

The operating costs of a computer network are determined by the following formula:

$$P_{\text{Э}} = P_{\text{ЗП}} + P_{\text{ОТЧ}} + P_{\text{НАКЛ}} + P_{\text{а.о}} + P_{\text{ЭЛ}} + P_{\text{рм}} + P_{\text{об}} + P_{\text{аб}} \quad (2)$$

где $Р_э$ - operating costs; $Р_{зп}$ - expenses on the total salary of employees serving; $Р_{отч}$ - expenses for deduction from wages to social protection funds; $Р_{накл}$ - expenses on deductions from salaries for the maintenance of the management staff; $Р_{а.о}$ - depreciation charges; $Р_{эл}$ - energy costs per year when using; $Р_{рм}$ - the cost of consumables; $Р_{об}$ - the cost of training users to use; $Р_{аб}$ - subscription fee to the service provider (for the global network).

An analysis of the principles on which the design of management information systems is based has shown that the information resource system contains two components: ensuring effective communication with the external environment and an internal component. Direct and indirect institutions of the external environment influence the establishment of requirements at the "entrance" and "exit" of the enterprise, some of which can be formalized to the level of indicators of compliance with these requirements. A universal tool for ensuring interdependence with the external environment is the mission of the enterprise and the chain following it: goal - strategy - objectives - policy. At the last stage, it becomes possible to

determine the indicators that are entered into the management information system. One of the possible methods of carrying out such work is to identify critical success factors based on the mission.

**Conclusion**

To develop a methodology for calculating the costs of developing, implementing and operating an information resource system for managing industrial enterprises provides the following advantages.

Cost calculation methodology:

1. System development costs:

- costs of system design: Definition of system requirements, development of technical specifications, creation of project documentation.
- programming costs: Development of software for data collection and analysis, creation of an interface for users.
- testing costs: Testing the system for compliance with requirements, correcting errors and bugs.

2. The cost of implementing the system

Equipment purchase costs:

- purchase of necessary equipment for data collection and transmission, servers and other equipment for data storage and processing.
- installation and configuration costs: Installation and configuration of equipment, network connection, software configuration.
- personnel training costs: Staff training to work with the system, seminars and trainings.

3. The cost of operating the system - Maintenance costs: Regular hardware maintenance, software updates, bug fixes and bug fixes.

- energy costs: The consumption of electricity for the operation of the equipment.
- repair and replacement costs: Repair and replacement of equipment in case of breakdown or wear.

4. Costs of integration with existing systems Interface development costs:

- development of interfaces for integration with existing enterprise management systems.
- integration testing costs: Testing the integration of the system with existing systems.

5. Cost estimation methods:

- direct cost method: Cost estimation based on the actual costs of system development, implementation and operation.
- method of analogues: Cost estimation based on cost analysis of similar systems already developed and implemented.
- expert assessment method: Cost estimation based on expert assessments of specialists in the field of information technology and industrial management.

The methodology for calculating the costs of developing, implementing and operating an information resource system for managing industrial enterprises should take into account the costs of developing, implementing and operating the system, as well as the costs of integrating with existing systems, and use various cost estimation methods to obtain the most accurate results.

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