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The use of IT technologies in the implementation of the "economic cross" methodology in the "Breakthrough" project of Rosatom

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Abstract

The article analyzes the economic barriers that slow down the development of the Rosatom "Breakthrough" project and reduce its economic efficiency. The foreign experience of implementing projects of similar scale and significance is considered, the reserves for adapting foreign experience with respect to solving specific economic problems of the development of the Breakthrough project are identified. The necessity of increasing the use of the scale of digital technology in the framework of the development of the Breakthrough project and its more complete adaptation to the digital economy format is substantiated. Much attention is paid to the use of digital technologies to maximize positive and minimize negative external economic effects associated with the implementation of the project, especially in the long term. The proposals formulated based on the results of the study are built taking into account the current practice of using IT support in the framework of the Breakthrough project.

Keywords: цифровизация, экономическая эффективность, методика экономического креста, атомная энергетика, проект «Прорыв», формирование коммуникационных сетей, стратегическое планирование.

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1. Introduction

Relevance. Modern nuclear power economy is characterized by the growing importance of strategic planning and the unacceptability of using the experimental method. First of all, this applies to research projects that have no analogues abroad. Among the most significant such projects of the state corporation Rosatom is the "Breakthrough" project related to the creation of a fast neutron reactor.

Strategic planning for this project is complicated by long planning periods in the context of a dynamically developing technological context for the functioning of nuclear energy. The first phase of the Breakthrough project took 20 years. This period makes it difficult to introduce innovative solutions into production with the use of scientific solutions created in related fields, in particular materials and IT technologies.

The identified problem necessitates the formation of a methodology for timely detection, assessment of the economic feasibility of using and introducing innovative solutions into the energy cycle throughout the entire period of the strategic plan. The most significant indicators for this technique should be:

- the ability to work with significant amounts of information and use in big data format with minimal transaction costs;
- maximization of the number of potential project partners with whom the organizers of the project communicate. To assess the economic efficiency of interaction with each of these partners, you should assign them standard criteria, the assessment for each of which will change in time, preferably in real time;
- the relevance of the methodology for each of the participants in the economic process, especially for potential inverters and direct consumers of nuclear energy products, as well as scientific and research organizations.

A tool for ensuring compliance of the methodology with the specified requirements is the digitalization of actions related to the organization of design work. Currently, within the framework of the Breakthrough project, digital technologies are used quite actively, but they mainly accompany the technological process. There are reserves to use digitalization in the framework of modeling not only technological, but also economic processes.

Objective: The purpose of this article is to determine the potential for using IT technologies in the implementation of the "economic cross" methodology in the "Breakthrough" Rosatom project and to develop specific proposals for adapting and integrating specific technologies for solving economic problems.

To achieve this goal, the authors set and solved the following tasks:

• identification of directions for expanding the information and communication network of partners in the framework of the Breakthrough project;

• determination of restrictions on the development of the information and communication network of partners in the "breakthrough" project, due to technical and logistical reasons;

• study of foreign experience in the formation of the information and communication network of large corporate and national innovation projects;

• identifying the potential for using scaling in the implementation of the Breakthrough project and determining the reserves of global economic resources for the development of this project;

• development of proposals for the use of digital technologies in order to ensure maximum economic efficiency of the information and communication network of the "breakthrough" project.

The authors' suggestions are formed taking into account foreign experience in using IT technologies in organizing strategic planning of budget spending for major national projects abroad in the context of the digitalization of the economy. Considerable attention has been paid both to ensuring the economic efficiency of using digital technologies in the "breakthrough" project, and to the possibility of integrating domestic innovative nuclear energy as the flagship of global nuclear energy of the 21st century.

2. The statement of the problem: cost efficiency of economic cross in nuclear energy through digitalization

The key problem of organizing strategic project planning in nuclear energy is the length of the planning period. The high time and financial costs of creating and implementing advanced innovative technologies in the field of nuclear energy negatively affect the flexibility of strategic plans and projects and the ability to integrate the latest technological solutions created after the approval of the project concept.

In addition, as foreign experience shows, in 2010 - 2020 there is a higher growth rate of costs for innovative design in nuclear energy and ensuring the operation of power units created in accordance with new technology compared to previous periods.

This trend is especially pronounced for developing countries that are forced to use related technologies and equipment purchased in the US and other countries in energy production. The increase in the cost of energy generation is presented in Figure 1.

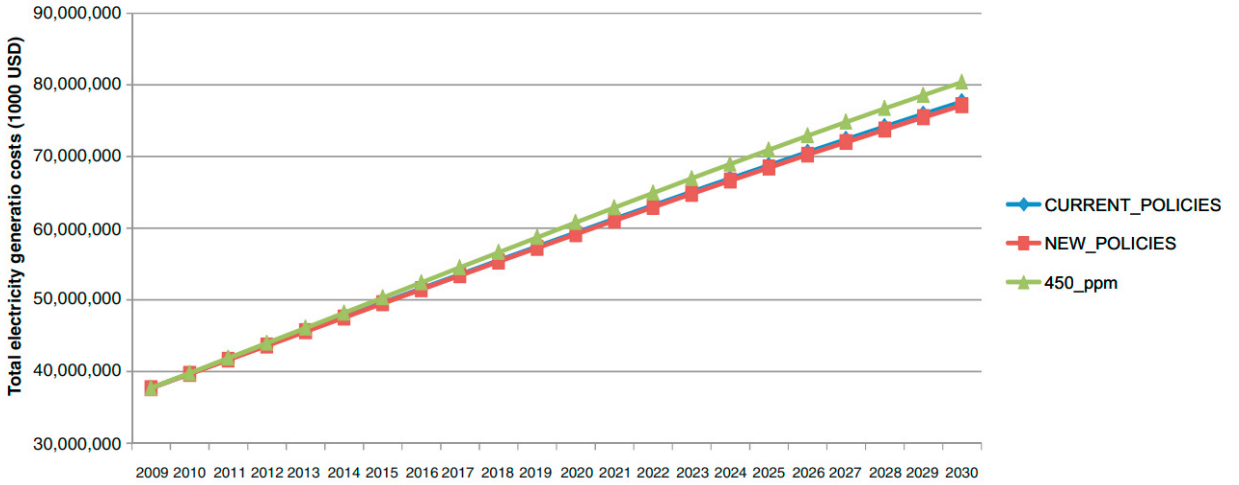

Fig. 1 Total electricity generation costs in low – develop countries in 2009 – 2018 and forecast for 2020 – 2030 [11]

The dynamics of growth in energy costs presented in Figure 1 is primarily due to an increase in energy demand in developing countries, such as China and Turkey. With the further expansion of the outsourcing chain of multinational companies to other territories, in particular, to the African continent and Asian countries that are currently poorly integrated into global production, this dynamics may adversely affect the development of the energy sector. The reason is the lag in the growth rate of energy consumption and its cost from the growth rate of the global economy.

It should be noted that the stated problem will remain relevant for both the current economic policy of energy companies and the successful implementation of the policy changes announced by most energy companies towards energy conservation [9].

Since the results announced in the Breakthrough project are planned to be updated on the global energy market in early 2030, the use of traditional cost management tools for this project is associated with significant risks of a payback crisis associated with a slowdown in global economic growth. In order to reduce the corresponding risks, a more active adaptation of the cost management system within the framework of the Breakthrough project is proposed, taking into account market changes in the global energy market, global demand and achievements in innovation. Such conceptual changes are possible based on a reorientation to the use of technologies for virtual designing business processes based on the model of an open energy "economic cross" and the formation of an infrastructure for interacting with the business environment in an online format.

3. Оценка перспектив использования цифровых технологий для повышения экономической эффективности бизнес – процессов на разных этапах «экономического креста» в атомной энергетике

IT technologies are widely used in nuclear energy in Russia and abroad in the design and construction of reactors, the creation of nuclear fuel, and in the implementation of technological design. An empirical analysis of the economic efficiency of the use of digital technologies in this field and a comparison of the results with the corresponding results of economic efficiency for earlier projects that do not use digital technologies, indicates the high economic attractiveness of digitalization [6]. Analysis of the coverage of modern nuclear technology projects in the field of nuclear energy indicates their predominance in the organization of modeling the internal environment. Indeed, for

more than 87% of all technological processes in nuclear energy, a digital model has been built that significantly reduces the risk of an emergency situation at further stages related to field trials. The processes involving interaction in the external environment within the framework of the functioning of the “economic cross” of a single energy process are currently covered by digitalization to a much lesser extent. In the USA, at present, digital analoguesb are created for no more than 32% of the corresponding processes [5].

It should be noted that the study of the economic efficiency of digitalization of the corresponding processes demonstrate no less, and sometimes higher indicators of economic efficiency growth. The results of the economic assessment of the percentage increase in the effectiveness of the introduction of IT technology in the processes of interaction between the energy company and the environment at various stages of the "economic cross" are presented in Figure 2.

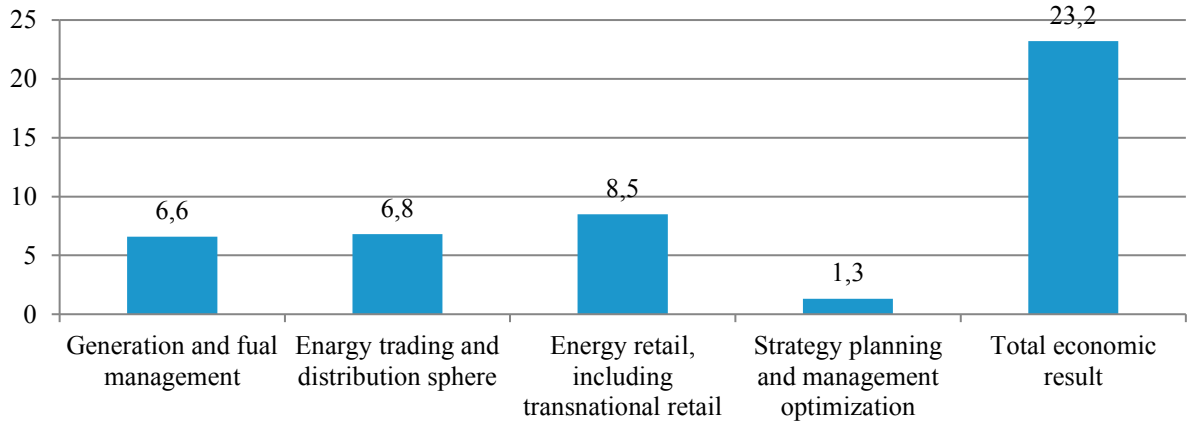

Fig 2. Percentage increase in earnings of energy sphere enterprises Due to the introduction of digital technology implementation in all stages of economic cross [6]

The greatest economic efficiency due to the use of IT technologies when interacting with the external environment is observed in the field of energy resale, especially in the global market (8.5%). A slight lag is observed actually for the sphere of production and development of nuclear fuel (6.6%) and the sphere of energy trade in the primary market (6.8). The observed economic effect is ensured by solving the following tasks through the introduction of IT technologies:

- tasks of scaling economic processes and increasing the number of potential partners;
- increasing the speed of processing requests from potential partners and improving the quality of such processing at the initial stages, which is associated with the ability to automate the study of primary proposals through the use of standard analytical programs;
- expanding the information space in which the innovation process takes place, and providing more rapid detection of prospects, but little-known technologies, corresponding to the requests for this project.

In addition, the digitalization of the process of strategic development of projects in the field of nuclear energy makes it possible to minimize costs when it provides the possibility of full duplication of standard "traditional" processes. Figure 3 presents a comparative description of the costs of ensuring the flow of standard processes in the crayfish of nuclear energy development projects in the countries of the Organization for Economic Cooperation and Development. For the purposes of this article, an excerpt is provided containing averaged indicators.

Note that the indicators shown in Figure 3 are minimal for the processes, the course of which is ensured by IT technologies. The combination of traditional and digital technologies can give less attractive indicators. In addition, the combination of traditional and digital technologies during the transition period can lead to a significant increase in the risks associated with the loss or distortion of information.

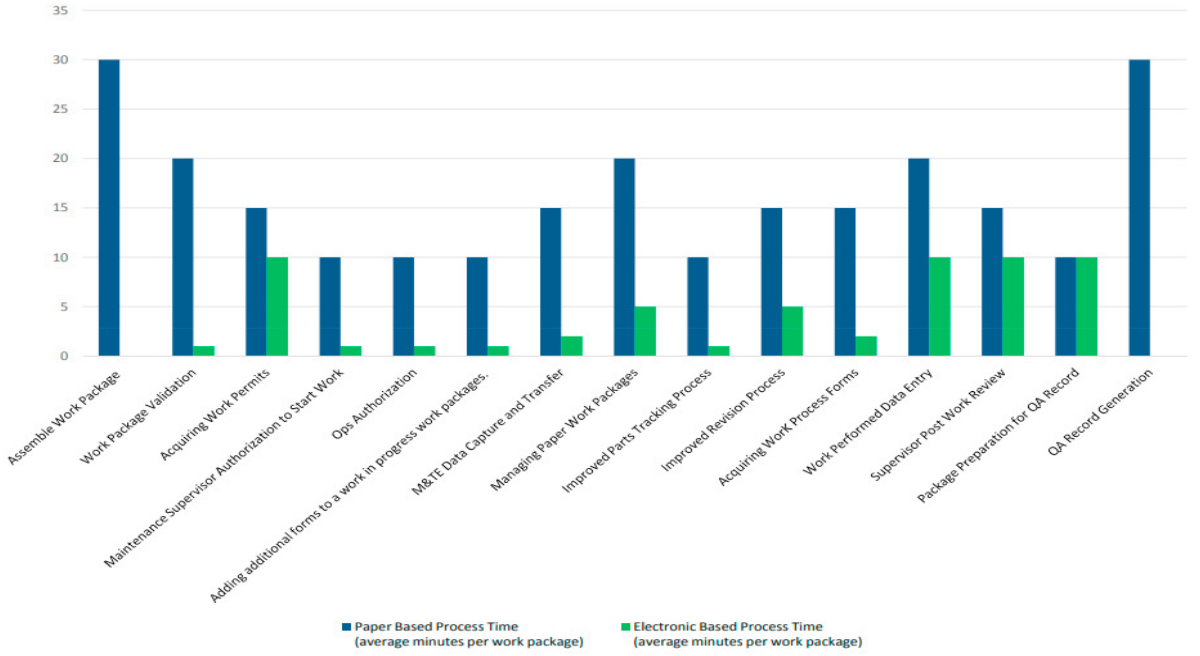

Fig 3. Workflow Comparison of Paper to Electronic Activity Duration for main transaction business processes through the «economic cross» of nuclear energy production system [7]

The specified economic feature determines the desire of companies designing technologies with long payback periods. Therefore, the most attractive project in the economic sense is a complete reorientation of the business process to the use of IT technologies instead of traditional ones.

4. Ways to integrate IT technologies in the framework of the Breakthrough project based on the methodology of the economic cross

The introduction of information technology in the process of developing a project in nuclear energy requires more caution than in other areas. This is due to the long payback periods of the project, which increases the risks of obsolescence of the technology used and actualizes the problem of technological compatibility of IT solutions in time.

The model for choosing the implementation methodology is presented in Figure 4.

The presented model is interesting in that it provides the possibility of multi-criteria selection of decisions in the IT sphere. This advantage is especially important in pioneering projects, such as the Rosatom “Breakthrough” project. The inability to use the experience of foreign companies operating in the energy sector requires the project management to make a decision based only on its own opinion on IT - developments that have their own background and are adapted to the needs of other energy projects.

Another advantage of the proposed algorithm for selecting the IT component is its compliance with the requirements of economists who are involved in interacting with the external environment and are not professional nuclear scientists.

The most promising of the existing methods of strategic planning for the implementation of information technology in the process is the model of the economic cross. This model allows you to calculate the value of discounted cash flow throughout the resource and production cycle in their relationship.

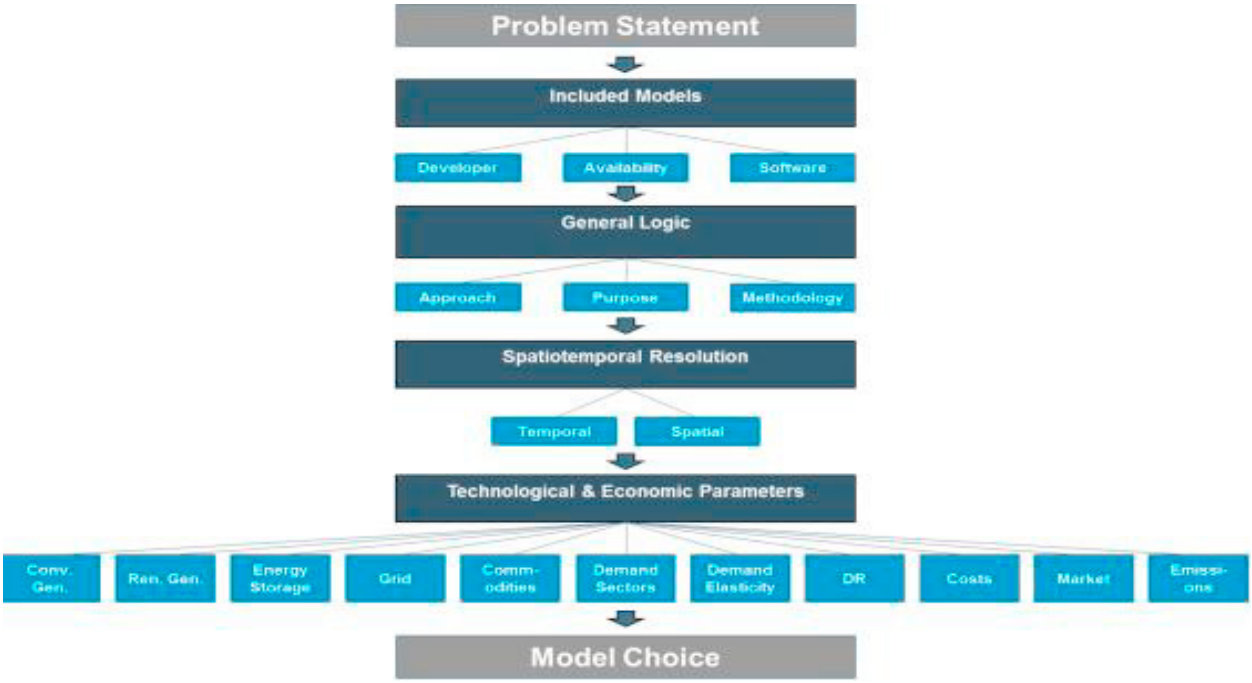

Fig. 4 IT selection algorithm - technology for evaluating and predicting the efficiency of a closed fuel cycle, suitable for use in the framework of the Economic Cross model [3].

This makes it a valuable tool for predicting changes in the economic efficiency of production and organizational processes due to the introduction of IT technologies in the fuel cycle.

In order to intensify the digitalization of the planning and modeling process of the “Breakthrough” project with the external environment, it is proposed to include IT support for the component proposed for integration into the “economic cross” with an integrated IT component. With regard to the IT component, the development of a set of indicators of economic efficiency along with the element proposed for integration may be recommended. The stated criteria can be formed simultaneously with the criteria of economic efficiency of the element itself. The proposed procedure for integrating IT technologies in the implementation of the “economic cross” methodology in the “Breakthrough” Rosatom project.

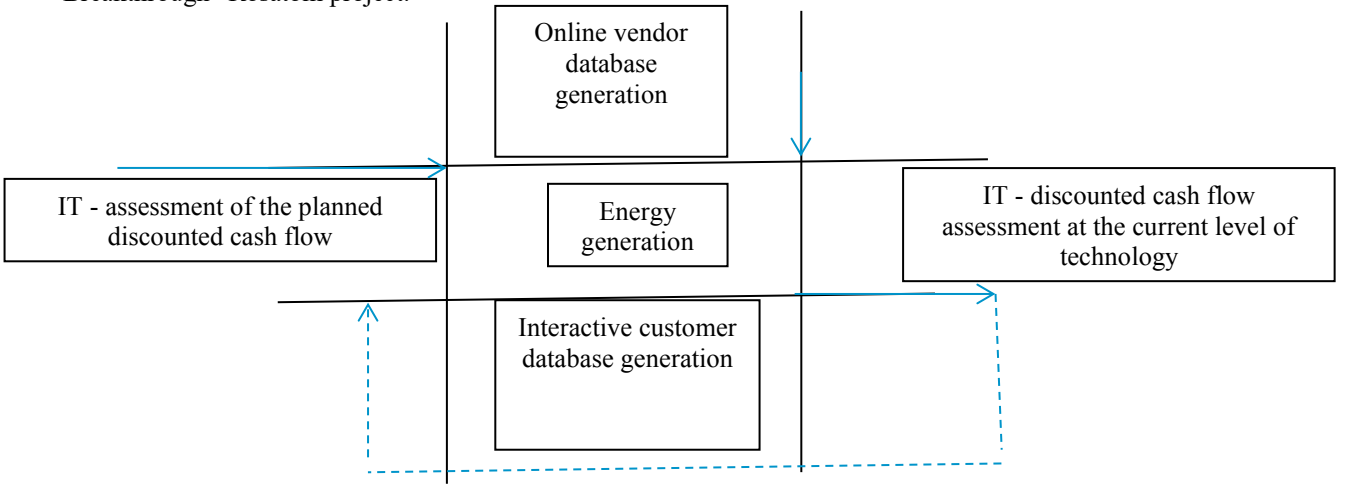

Fig. 5. The procedure for integrating IT technologies in the implementation of the “economic cross” methodology in the “Breakthrough” Rosatom project [12], [13], [14].

The arrows in Figure 5 indicate the movement of information about the estimated financial flows. Information using the proposed format is transmitted to the expert system of the Breakthrough project in real time and, when the criterion of relative economic efficiency is met, is transmitted to the administration. The integration of IT technologies in the sectors of the economic cross indicated in Figure 5 will increase the transparency of the competitive participation of project partners in tenders and tenders, while ensuring conditions for their growth and scaling up the search and selection process for partners.

5. Conclusions

Thus, the use of IT technologies in the implementation of the "economic cross" methodology in the "Breakthrough" Rosatom project will make it possible to increase the economic efficiency of interaction between project participants and the external environment. In particular, due to digital modeling of the economic cross in time and automation of the processes of working with primary information on the proposals of potential partners, it is possible to scale the conducted tenders while maintaining the quality of their organization. The project on digitalization of communication channels with the environment described in the article is interesting from the point of view of organizing interaction with foreign partners, the proposals and requests of which are described by unsystematized criteria.

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