

Integration of Innovative-Information and Production Business Processes Into Digital Technologies of the Industrial Complex of Russia

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Abstract. Innovative development of informatization systems in the industrial sector comes under the scrutiny of both business entities and the state. Informatization tools used by industrial enterprises are the key to improving efficiency and developing innovative activities. Business processes in industry are based on the application of digital technologies through the use of informatization tools.

The authors of this paper propose a mechanism for the integration of innovative-information and production business processes into digital technologies of the industrial complex of Russia, which creates additional incentives for the development of innovative activities: it improves technologies of digital processes, scales up innovation, intensifies activities, and improves the performance of enterprises primarily through the use of digital technologies, as well as through the development and application of dual-use technologies.

The authors clarify and supplement theoretical issues of innovative-information and production business processes integration into the development of digital technologies of the industrial complex, propose forms of industrial business organization using digital information technologies, and substantiate that integrated productive-economic and innovative-information system should be considered as a leading economic category in the industrial sector.

The authors developed a model for the control of the integration of innovative-information and production business processes into digital technologies of the industrial complex based on a digital business accelerator.

1. Introduction

The integration of innovative-information processes and production business processes into digital technologies of the industrial complex currently determines the development trends of leading industrial enterprises in Russia. Development strategies of many enterprises imply that the active use of informatization and informatization systems contributes to an increase in labor productivity, and, consequently, performance efficiency. This gives new, additional opportunities for the introduction of innovative technologies in production and release of innovative products.

The development of business processes based on the active introduction of innovations, as well as using large volumes of digital information allows structuring and building production technologies in a new way. An innovative-information process contains an idea that, when combined with a production business processes, is transformed into a project and then into a technology that is in demand for use in production.

To implement this integration idea, it is necessary to create a business accelerator as a program for accelerated project implementation. Moreover, it is proposed to start using an accelerator at the stage when there is an idea and it needs to be implemented through R&D giving this idea certain parameters that correspond to the market conditions for new products selling. In this case, to accelerate the introduction of innovations, it is proposed to use digital technologies that create a special environment of accelerated growth from the inception of the idea to the beginning of investment, personnel training, use of consulting, mass media, market information and other branch enterprises, providing opportunities for project presentation to potential investors.

To maintain a leading position in the market, an industrial sector enterprise needs to either increase labor productivity reducing the cost of production or introduce new types of products to the market that are in demand by consumers, i.e. increase its value. Hence, there is a need for digital technologies and innovative ideas, on the basis of which effective managerial decisions are made to optimize business processes of industrial enterprises. In order to meet the world trends of global market development, it is necessary to accelerate the integration of innovative-information processes and production business processes into digital technologies of the industrial complex using digital accelerators.

The value of digital business accelerators is determined through the creation of effective communications between a business idea transformed into an innovative project and its commercialization in the market using the financial resources of investors, as well as implementing a set of activities within the acceleration program to accelerate the placement of an innovative product on the market.

The study shows that it is necessary to integrate innovative-information processes and production business processes into digital production technologies in order to increase the efficiency of the industrial sector.

2. Relevance

The domestic industry, which chose innovation-based development described in the Strategy for Innovative Development of Russia up to 2020 as the main development trend, focuses on innovative activities based on large industrial structures that use innovative information and digital production processes in their activities. The innovative and information environment of the industrial sector determines the priority areas for the modernization and development of innovative activity in the activities of industrial enterprises.

At the present stage of Russian industrial complex development the topical issue is the creation and development of a universal mechanism for the control over the integration of innovative-information and production business processes in industry that will create additional incentives for the development of innovative activities: creation of digital production technologies, increased activity intensification and efficiency [8].

The development of the integration of innovative-information and production business processes of the industrial complex is a consequence of the innovative development of enterprises followed by the receipt of new added value of products.

Domestic scientists mention the lack of a mechanism for the control over the integration of innovative-information and production business processes, as well as elements of the innovation environment of industrial structures and their uncoordinated activities as the main reason that hinders the innovative development of the domestic industry [7].

The lack of research with respect to the issues of integration of innovative-information and production business processes into digital technologies of industrial complexes, its role and place in the Russian economic system, as well as the degree of impact on the performance and activity of innovation activity determine the objectives of this work.

The **scientific relevance** of this study involves the addition of theoretical concepts and practical recommendations on the integration of innovative-information and production business processes into digital technologies of industrial complexes. It presupposes the following:

- Updating and supplementing theoretical issues of integration of innovative-information and production business processes into the development of digital technologies of the industrial complex.
- Suggestion of the mechanism for the control over the integration of innovative-information and production business processes into digital technologies of the industrial complex of Russia, which creates additional incentives for the development of innovation activity: improving the technology of digital processes, increasing the innovation activity of industrial enterprises, increasing the intensification of the activity and performance through the use of digital technologies.
- Development of a model for the control over the integration of innovative-information and production business processes in industry based on a digital business accelerator.

3. Brief review of literature and opinions of authors on the subject under study

The theoretical and methodological basis of this paper is represented by works of foreign and domestic scientists in the area of development of the integration of innovative-information and production business processes into industry, as well as statutory and regulatory enactments of the Russian Federation, materials of the periodical press and scientific conferences on the issues of innovative development of industry, and statistical data. The methodological basis of the paper is a systematic approach, methods of general scientific, economic and statistical analysis, etc.

The term “innovation” was introduced by J. Schumpeter in the first decade of the twentieth century. He defined a change in the introduction and use of new consumer goods, production facilities, forms of organization of enterprises as an innovation [19,22]. A prerequisite for the study of the role of innovation in economic development are papers of N.D. Kondratiev [17]. He conducted an analysis of long waves (large business cycles), which resulted in a study of factors, reasons, and duration of these cycles. The main condition for the economic development was innovation. The approach to the economic development based on innovation had a strong influence on J. Schumpeter, the founder of the discovery of innovations.

Among domestic scientists studying issues of innovative development we can mention S.Yu. Glazyev [7], who introduced the concept of a technological paradigm in the modern use of this term, as well as Yu.V. Yakovets [16], who singled out technological development cycles and connected them with the periodization of scientific and technical revolutions, where technological innovation is the basis.

D.I. Kokurin and a number of researchers adhere to the following definition: innovation is the process of implementing novelty in specific market conditions, a certain idea, documented, developed and adapted for use [9]. This reflects the aspect of the commercialization of innovations.

Scientists focus on different properties of innovation in modern scientific research: prerequisites for the emergence [6], implementation processes [4, 24], results of use, the connection of innovations with problems [12], ideas [14, 23], and knowledge [18] is emphasized.

Another group of scientists distinguish innovation from improvement or local improvement of any product: innovation requires a set of specific organizational and technological actions, reorganization of business processes of an enterprise, changes in the behavior of potential consumers [13] for the purposes of its use.

F. Nixon, one of the main founders of the theory of innovation, represents innovation in his works as a system and interprets this concept as a complex of scientific, organizational and production factors with the motivation of entrepreneurship created for the production of innovations [14, 19, 21, 23]. According to his theory, there are five types of changes: use of new raw materials; introduction of new methods and technology; organizational changes in production; production of new products; creation of new markets.

Theoretical and methodological developments on the creation and development of processes of innovative-information and production integration in the industrial sphere were studied in the works of A.I. Abalkin [4], S.I. Ashmarina, B.A. Denisov, Zh.A. Ermakova [8], L.S. Mokina [10], E.V. Sibirskaya [13], B. Ya. Tatarskikh, E.G. Yasin [17], etc.

S.A. Aliyev in his work notes that the integration of informatization processes and technologies of industrial enterprises directly depends on the effective management of information used as a resource. Integration is a management problem with a large number of technical issues [6, 12].

In the works of K.M. Shorov the integration of information technology is associated with the introduction of automated control systems in industrial production in order to improve the efficiency of operation [15, 17].

O.A. Stroeva notes that the integration of innovative-information and production business processes into digital technologies of industrial complexes presupposes that information in production is structured across the integrated structure of the enterprise, but not by individual subdivisions or subsystems [23].

S.V. Ratner focuses in his papers on the implementation of innovative projects through the use of innovative-information networks as an integrating starting point [11].

President of the Russian Federation V.V. Putin proposed to create a large-scale program for the development of domestic digital economy in his address to the Federal Assembly in 2016. In July 2017 the Government of the Russian Federation approved the Program for the Development of Digital Economy up to 2024 [3, 4].

This Program determines that economy digitalization is a modern global trend. It reflects the forecast of potential development of breakthrough technologies, presents a list of national and interstate programs to stimulate digitalization processes in the Russian economy, discloses directions of digital solutions for the state, domestic business and citizens, offers recommendations for eliminating risks and creating conditions for the development of a digital economy [1, 3].

4. Setting objectives

It is required in this paper to clarify and supplement the theoretical concepts of integrating information technology and business processes with production processes of industrial enterprises, offer practical recommendations for the creation of a management mechanism and development of a model for the control over these processes based on a digital business accelerator.

5. Theoretical part

The paper proposes the author's approach to the integration of information technology and business processes with production processes of industrial enterprises based on the creation of an integrated innovative-information environment (IIIIE) of the industrial sector of the Russian Federation. It is proposed to include enterprises and organizations into this complex from the point of view of their functionality. So, it turns out that the IIIIE is a functional subsystem that is a part of the system ensuring the innovation activity of industrial enterprises. The main difference between the proposed organization of IIIIE activity as part of the innovation activity support system and the existing innovation activity support systems is that the authors propose functional structuring of business processes of an industrial enterprise. This structuring is reflected in the fact that the basis of the innovation activity of enterprises is implementation of certain innovative projects. The authors propose to distribute these projects across business processes using the supporting infrastructure for their implementation (Figure 1).

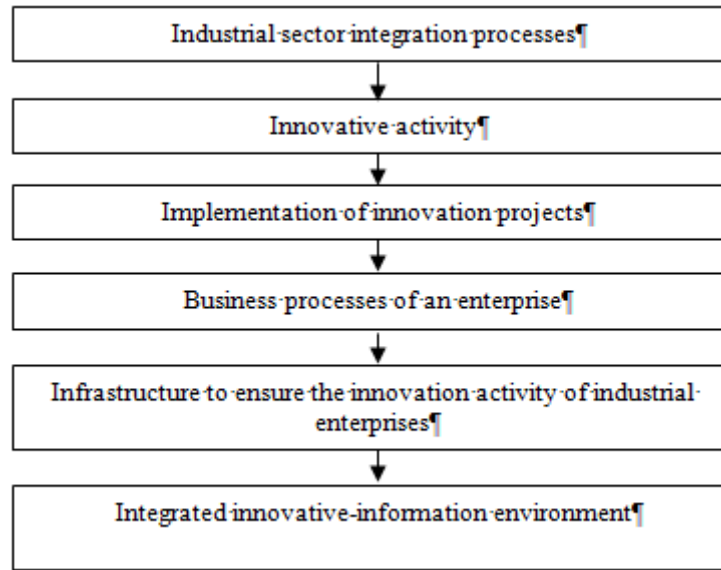


Figure 1. Integrated innovative-information environment of the industrial sector.

So, innovative projects are divided into business processes at an industrial enterprise, in which the information component plays a significant role, and their further implementation is connected with both production technologies and supporting business processes.

As a supplement to the theoretical apparatus of the research of integration processes the authors propose a definition of the integrated innovative-information environment, which refers to the existing and developing functions of enterprises and organizations providing innovative activities of the industrial sector based on business processes and information structuring, on their relationship with the implementation of innovative projects and production technologies used. Also, the IIIE can be presented as a set of conditions for innovative activity in industry.

The IIIE can be divided according to the specialization of industrial enterprises and includes scientific, informational, functional, technological, educational, social environments of activity. This division describes the conditions for the formation and implementation of innovative projects of an enterprise.

The subject-object structure of the IIIE is determined by a process-based approach to the management of innovative activities of an industrial enterprise, since subjects of innovative-information activities create objects (patents, licenses, innovative products) of this activity; they observe a certain sequence, use available resources, perform specific functions (production process) in the organization of their activities; the elements of the structure interact with each other to form conditions for further innovative development of industrial enterprises (create the process) [25,26].

The authors propose a comprehensive management mechanism based on combining information and innovative resources of enterprise digitalization technologies by the creation of links between the IIIE elements to manage integration processes of a complex of innovations, informatization, business processes and digital technologies of an enterprise (Figure 2).

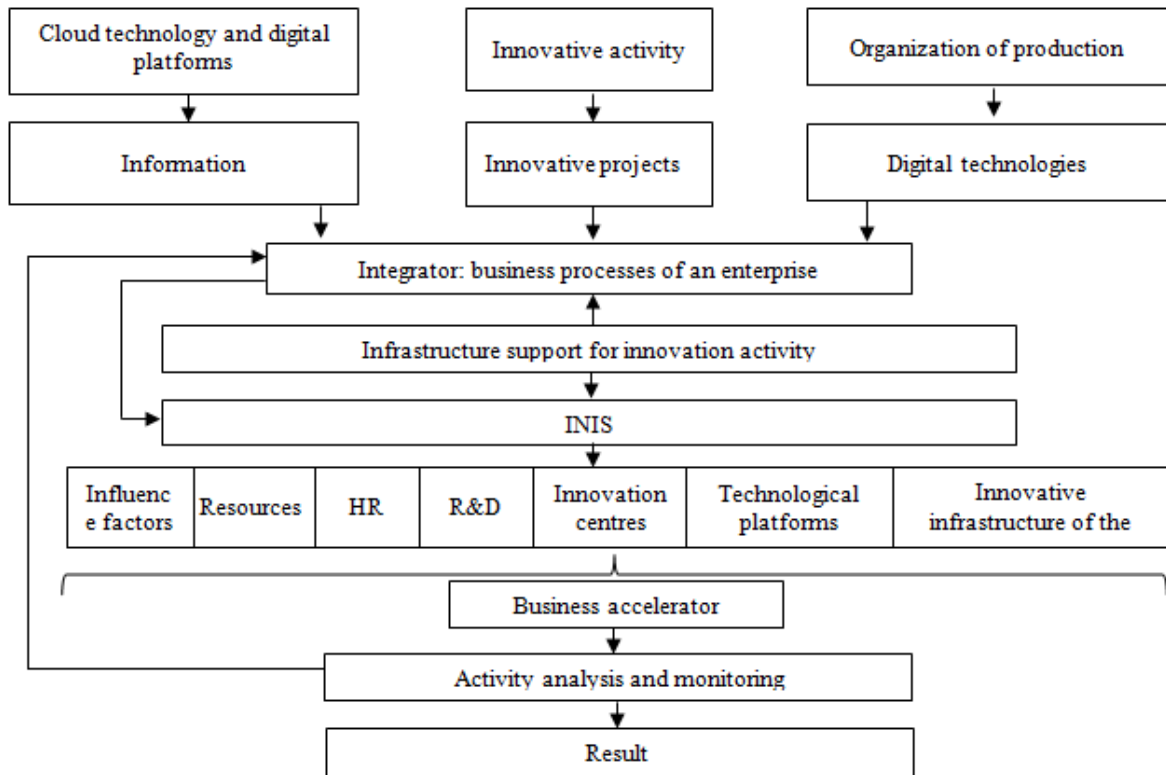


Figure 2. Integrated mechanism for the control of enterprise integration processes.

This mechanism is designed to control the innovation activity of an enterprise based on the integration of innovative-information and production business processes into digital technologies of an industrial enterprise, it is its subsystem, since innovative projects and innovation processes are implemented both within the enterprise and in the environment supporting innovative activities, which involves the use of control tools and techniques for the creation and implementation of innovations, as well as implementation of integration processes.

The authors propose to integrate innovative-information and production business processes into digital technologies of an industrial enterprise on the basis of an integrator of business processes of an enterprise uniting its activities in a single whole.

The author's novelty in this mechanism is the availability of a digital business accelerator in it. This tool for innovative activity development is a modern mechanism for the organization and financing of innovation of industrial enterprises. The digital accelerator is used for innovative projects at later stages of their implementation and its operation is commercial in nature [24].

In general, the objective of digital accelerators is to accelerate (through the use of digital technologies) innovative projects in the early stages of their implementation before the start of investment in the products of this project [18, 20].

Using the digital accelerator in the project, the enterprise uses mainly its own financial resources. The role of such financing is commercialization of innovations in the early stages of project completion [19].

The use of an accelerator has several advantages that are attractive to industrial enterprises:

- A digital, professional accelerator can more quickly and efficiently develop the project and bring it to a new stage as compared to other sources of financing.
- A digital accelerator solves issues that are associated with project financing, as well as legal, organizational, and technical issues.
- A digital accelerator can further expand the capabilities of the company owning IP to use the IP and reduce losses in case of unsuccessful project implementation.

6. Practical significance of the study, proposals and results of implementation, results of experimental studies

The authors evaluated the efficiency of integrated business processes of industrial enterprises - oil refineries of the Samara region. This evaluation was made using the method of expert evaluation. The top managers of the enterprises under study, representatives of state authorities, and scientific workers acted as experts. The evaluation was made using a point scale and weight ratios. The efficiency of business processes functioning was evaluated. The evaluation results are shown in Table 1.

Table 1. Evaluation of the efficiency of integrated business processes of industrial enterprises, 2019.

| Parameters | Kuybyshevsky Oil Refinery | Novokuybyshevsky Oil Refinery | Syzransky Oil Refinery |
|------------------------------------------------------------------------------------------------|------------------------------|----------------------------------|---------------------------|
| Business processes of building the organizational and technological structure of an enterprise | 7.4 | 8.1 | 7.6 |
| Business processes of enterprise management system | 7.1 | 8.1 | 8.3 |
| Business processes of integration of enterprises into a cluster | 7.8 | 6.4 | 5.5 |
| Information business processes | | | |
| Production, technical and technological business processes | 7.8 | 7.8 | 7.9 |
| Digitalization business processes | 6.1 | 5.8 | 4.9 |
| Financial and investment business processes | 7.6 | 7.7 | 7.9 |
| Supporting business processes | 7.5 | 7.4 | 7.9 |
| Market development business processes | 6.0 | 7.1 | 7.0 |
| Human resource management business processes | 6.4 | 6.6 | 5.9 |
| Product quality business processes | 7.7 | 8.3 | 7.9 |

The table shows that Novokuybyshevsky Oil Refinery is leading in terms of the efficiency. It is directly related to the fact that the company upgraded its basic production facilities and uses digital technologies in its activities.

7. Conclusions

1. Theoretical issues of integration of innovative-information and production business processes into the development of digital technologies of industrial enterprises were studied and supplemented.

2. A mechanism for the control over the integration of innovative-information and production business processes into digital technologies of the industrial complex of the Russian Federation, which creates incentives for the development of the innovative activity, was proposed.

3. A model for the control over the integration of innovative-information and production business processes in industry based on a digital business accelerator was developed.

8. Acknowledgment

This paper is an output of the science project No. 18-410-630001\18 “Development of mechanisms for financial provision of strategic development of the industrial complex of the Samara Region” of the Russian Foundation for Basic Research.

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