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## Aspects of Technological Modernization of Forestry Enterprise

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DINA IGOREVNA STYGUN<sup>1</sup>, ALEKSANDR VIKTOROVICH STYGUN<sup>2</sup>, BELLA  
OLEGOVNA KHASHIR<sup>3</sup>

<sup>1</sup>Docent, Kandidate of technical sciences

<sup>2</sup>Docent, Kandidate of Economics

<sup>3</sup>Professor, Doctor of Economics, Kuban State Technological University, Russia, 350072, Krasnodar, Moscow street, 2

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**Abstract:** The economic reality today is such that capitalization of the potential of robotics, biotechnology, digital technologies can lead to a technological revolution, to an explosive growth in labor productivity, which will lead to the restructuring of a number of industries, the depreciation of many production assets, a change in demand for professions, and increased competition. The experience of a number of countries has shown that an increase in the rate of economic development is possible only due to an innovative and technological breakthrough associated with the improvement of productive forces, a radical increase in the technological level, technological re-equipment of economic sectors, an increase in the share of high- and medium-tech industries, while technological modernization determines the economy's susceptibility to innovation activity. The progressive development of technological modernization in a highly competitive environment can bring the economy of the Russian Federation to a new level of development that meets the requirements of the time.

**Keywords:** forest, economics, ecology, recreation, biodiversity, monitoring, medico-ecological safety, cluster, innovations, investments.

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### INTRODUCTION

Radical technological changes accompanying the modernization of the economy and its transition to the post-industrial stage inevitably lead to the emergence of a complex of management problems, the solution for which has not yet been developed at the new scientific and methodological level. The process of innovation-based modernization involves overcoming the contradiction between the desire for a qualitatively new growth and the need for its financial support. A deep technological restructuring of the economy is not possible without the support of the state and without building partnerships between business structures and the government. At the moment, there is a discrepancy between the guidelines of state programs and strategies that implement the principles and objectives of the innovative economy, and in reality the existing situation with investment in technological modernization of production, with the level of innovative activity, with the contribution of research and development to the results of industrial enterprises. The policy of export orientation and import substitution requires domestic industrial enterprises to increase technological competitiveness, the understanding of the essence and methods of measurement which is blurred in the scientific literature. All of the above confirms the relevance of the topic of work and the need for a special study of theoretical and methodological provisions for planning, organizing and evaluating the effectiveness of technological modernization in new competitive conditions.

### METHODOLOGY

The dialectical development of the concepts of "modernization" is noted in the works of foreign and domestic specialists, the main factors of the technological development of enterprises, industries, regions and the economy of the Russian Federation are revealed, based on the conceptual foundations of managing the technological modernization of an industrial enterprise, taking into account the issue of the influence of technological modernization on the competitive position of the enterprise. Study of evaluation mechanisms for planning a scientific and technical product (STP) and determining the scientific and technical potential of economic entities, specific tools of modernization, the value of the innovative basis of technological modernization [1,12].

Studies of various aspects of the effectiveness of technological modernization are reflected in many works, and models and mechanisms of state support for enterprises have been investigated, however, despite the fact that research in the field of technological modernization is being carried out more and more every year, there are a number of unresolved problems, which, in our opinion, need more work, namely:

- indicators of the innovative activity of the enterprise;
- indicators of the degree of automation, mechanization and robotization;

- indicators of environmental protection and rationality;
- nature management of production;
- indicators of the technological and technical potential of production;
- indicators of the efficiency of technological processes and resource intensity.

The issues that remain unstudied to the required extent are related to the potential opportunities for technological modernization in the context of competition and state support of enterprises, measuring the effects of modernization in a situation of combining transformative forces, justifying the need for state support for technological modernization based on studying the competitiveness of industrial entities [2,9].

## RESULTS

All of the above has determined the topic of work, tasks, goal, analytical calculations and structure, which is to improve the tools for assessing the effectiveness of technological modernization of industrial enterprises and assessing the technological competitiveness of the Russian industry [3,8].

Based on the designated goal, the following tasks were set and solved in the work:

- systematized theoretical approaches to defining the economic essence of the category "modernization" and "technological modernization";
- the classification of technological modernization has been clarified and expanded in terms of the criteria for its selection and types;
- investigated the stimulating and inhibiting factors of technological modernization;
- generalized organizational models of technological modernization of enterprises;
- investigated and developed methodological approaches to assessing scientific and technical potential as the basis for modernization;
- substantiated significant effects and proposed methods for assessing the effectiveness of technological modernization for industries and industrial enterprises;
- developed a toolkit for assessing the need for state support for the modernization of industries based on an assessment of technological competitiveness;
- built a profile of the technological competitiveness of industries;
- systematized instruments of state support for technological modernization;



**Fig.1: Strategic goals and attractiveness matrix of a forest enterprise**

- the elements of the protectionist model of technological modernization for the industry are substantiated;
- presented an economic justification of the effectiveness of the mechanism of public-private partnership in the field of technological modernization of enterprises and industries.

The object of the research is large forest industry enterprises, which are a set of organizational and economic relations arising in the process of technological modernization of industrial enterprises with a theoretical basis for the results of scientific research of domestic and foreign scientists in the field of managing the scientific and technological potential of forest enterprises, developing competitiveness based on the modernization of production [4,15].

The informational basis of the study was formed by legislative acts of the authorities of the Russian Federation, information and statistical data on the socio-economic development of the region, normative and reference information, scientific literature, in the form of scientific and applied reports, monographs, conference materials,

articles in specialized and industry scientific journals, Internet portals, reporting of forest industry enterprises [5,14].

The degree of reliability of the results of the study is due to the use of a wide range of methods, the complexity of the consideration of the problems posed, a deep theoretical and methodological base of the study, the objectivity of the empirical data base and works carried out with theoretical, methodological conclusions of the practical results of the study tested at international and regional scientific and practical conferences.



**Fig.2: Factors of investment attractiveness of a forest enterprise**

The scientific novelty of the research lies in the identification and solution of a number of major theoretical and methodological problems within the framework of determining the tools for assessing, analyzing and managing technological modernization:

- The theoretical foundations of technological modernization of industrial enterprises were developed by generalizing the concepts, factors and organizational models of technological modernization of industrial enterprises, expanding the classification of types of technological modernization, which revealed the feasibility of developing [6, 12] a protectionist model of technological modernization in the direction of public-private partnership, which allows relatively to achieve a restructuring of the industry and an increase in the technical level of production in a short time;
- A methodological approach has been developed to assess the results of technological modernization of enterprises, based on measuring the level of manufacturability and innovativeness of production, which allows, based on the construction of matrices, to rank industrial enterprises within the industry according to the degree of need for technological modernization and to group industrial entities by the level (high, medium, low) of the effectiveness of technological modernization.
- A toolkit for assessing the technological competitiveness of industrial entities is proposed, based on measuring technological innovation, the level of development of information and communication technologies, involvement in foreign trade, the volume of investments in the industry, environmental friendliness of business, the degree of business concentration, which makes it possible to substantiate the need for state support for modernization and clarify acceptable for technological modernization enterprises of a specific industry options for forms of public-private partnership.
- Concepts, organizational models, factors and classification of types of technological modernization of industrial enterprises.
- Methodology for determining the results of technological modernization of an industrial entity and methodological approaches to measuring the scientific and technical potential of an industrial enterprise as a tool for assessing the need for its technological modernization.
- Toolkit for assessing the technological competitiveness of industrial entities used to substantiate the need for state support.

The practical and theoretical significance of the study lies in the application of recommendations and a methodological approach, which make it possible to obtain an objective assessment of the need to introduce

technological modernization in the context of competition and state support of enterprises. The findings and studies can be applied by public authorities to take measures to stimulate forest industries for technological modernization, by public and private investors to make decisions on allocating funds to enterprises to improve fixed production assets and increase the innovative component of regions, higher educational institutions for teaching disciplines [7,11].

**DISCUSSIONS**

The relevance of the problem of managing technological modernization in the context of competition and state support of enterprises, the state of knowledge of the indicated problem is analyzed, the goals, objectives, object and subject of the study are formulated, the provisions that determine the scientific novelty of the study are given, the theoretical and practical significance is revealed, information on the testing of the main results research [4,8].

Since the listed NCCI indicators have different units of measurement for integration, it is necessary to convert them to an index form. In that case, an additional advantage of the technique is obtaining a dynamic assessment. The general formula for calculating the private indices of all private indicators of the NCCI is:

$$i = P_n / P_{n-1}$$

where:  $P_n$  and  $P_{n-1}$  private indicators of the assessment of NCCI for the reporting and previous year.

The group indices are calculated by averaging:

$$I = \sqrt[m]{P^M} \cdot i_j$$

where  $i$  – private index of NCCI for the  $j$ -th private indicator;  $j = 1, \dots, m$ .

It is also advisable to determine the integral index of the NCCI on the basis of averaging the group indices:

$$I_{NCCI} = \sqrt[3]{I_{IA} \cdot I_{MAR} \cdot I_{RN} \cdot I_{TP} \cdot I_{TE}}$$

where  $I_{IA}$  – innovation activity index;

$I_{MAR}$  – index of mechanization, automation, robotization;

$I_{RN}$  – rational nature use index;

$I_{TP}$  – development of technological potential index;

$I_{TE}$  – technology efficiency index.

Methodological foundations for assessing resources and the results of technological modernization of industrial enterprises organizational models of technological modernization are systematized, the need for accounting is substantiated and a methodology for a generalized measurement of the scientific and technical capabilities of an enterprise is proposed, methodological approaches to assessing the effectiveness of modernization are developed, which aspects of assessing the effectiveness of interaction between business and government [8,10].



**Fig.3: Aspects of technological modernization of forestry enterprise**

Theoretical aspects of technological modernization of industrial enterprises determine the content of neo-industrialization processes, the challenges of a new technological revolution, the concepts of modernization are identified, as well as approaches to the interpretation and targets of technological modernization of an

enterprise, with an expanded classification of types and clarifications of the list of factors of technological modernization [9,13].

Recommendations for increasing the effectiveness of technological modernization (Table 1) of industrial enterprises on the basis of public-private partnerships, the characteristics of global production systems are presented, the need for state support based on an assessment of the technological competitiveness of industries is substantiated, instruments of state support for the development of the technological sphere are identified, problems and drivers of the use of state-private partnership, recommendations were given to expand the use of the benefits of public-private partnership in technological modernization [3,9].

**Table 1: Matrix of types of technological modernization**

		Technological level of existing industries	
		transforms	does not transform
New production	appear	Investment and innovation modernization	Innovative modernization
	do not appear	Investment modernization	Conservative modernization

**Table 2: Systematization of concepts of technological modernization**

Approach to definition	Interpretation
Technological modernization as transformation, improvement of production	The form of realization of the competitiveness of economic systems based on the renewal of the production apparatus, replacement of outdated technologies and equipment with efficient ones
Technological modernization as a state policy	Transformation of the socio-economic system of the state and the structure of the economy on the basis of innovative tools and methods of production of new goods, services and knowledge
Technological modernization as a strategy	Adaptation strategy of the object of modernization to the changing conditions of the external environment to increase its competitiveness
Technological modernization as a project	Linear universal project that allows you to go the way towards achieving the level of development of Western countries

**CONCLUSION**

Despite the existing negative assessments of the prospects for globalization of the economy, in the modern world, technological modernization is of a model nature, and it is based on innovative technological development. As it spreads to developing countries, it mainly touches cities and encounters culturally motivated resistance. A high technological standard is often hampered by the availability of cheap labor, which makes it impractical to use expensive equipment. Environmental standards have not yet become the main criterion for choosing between new and cheap technological solutions. These problems are partly inherent in the Russian economy. At the same time, it is difficult to argue with the fact that it is necessary to become a technological power within the framework of the fourth industrial revolution, focusing on the digitalization of the economy, the formation of a new export structure, technological entrepreneurship, the achievement of persistently low inflation, the simplification of foreign exchange control of customs procedures for the export boom.

Let us analyze the conceptual apparatus related to modernization to determine the content side of the process that ensures the development and effective growth of the economic complex. The concept of "modernization" in general scientific circulation was introduced in the middle of the XX century in Western countries when studying the issues of overcoming the socio-economic uneven development of countries. At the same time, it should be recognized that the modernization process is not new; at different times he accompanied historical changes in different countries, regions, industries, enterprises. The works of foreign and domestic specialists are devoted to the study of the dialectical development of the concept of modernization, the approaches to interpretation contained in them are combined by us into the following groups:

1. Modernization as a revolutionary transformation of social relations, a number of authors, describe modernization as a fundamental change in social relations, a radical institutional restructuring of the production potential of mankind, that in the historical meaning, modernization is a process of macro-transition from traditional society to a new conceptual organization, that modernization acts as a process, the result of which is transformation of agricultural, traditional societies into industrial, modern. At the same time, the modernization

transition affects every social institution, every population group, that modernization consists in the economic and political progress of individual societies, which then entail changes in lagging societies.

2. Modernization as a transformation of thinking, in particular, characterizing modernization as a process of mental shift, achieving such a state of mind, which is characterized by an unconditional belief in progress and gives rise to a tendency to economic growth and a willingness to adapt to changes, modernization is a process of releasing cognitive potential that arises together with a consistently rationalizing world. Modernization is accompanied by the prioritization of values such as science, knowledge, achievements.

3. Modernization as an improvement and improvement, the conceptual representation of modernization as a process of idealization reduces modernization transformations to updating and improving facilities, taking into account today's norms and requirements, with the process of bringing traditional production technologies to the "ceiling" of efficiency: the rate of annual productivity growth has been decreasing over the past years, which accompanied by changes in consumer demand parameters, an increase in the need for a customized product. Against this background, in the modern Russian Federation, the transition to an innovative path of development is defined as the most important goal of the country's policy in the field of technology and science development, the achievement of which becomes a necessary prerequisite for the modernization of the national economy and, ultimately, the formation of the competitiveness of production. Industrial enterprises of the Russian Federation today are faced with challenges associated with systemic innovative development, with a qualitatively new economic growth that takes into account environmental requirements, with investment equipment in a situation of significant qualitative changes in all spheres of life.

Interest in modernization as a scientific category and management activity is associated with the processes of neo-industrialization. Neo-industrialization (or re-industrialization) is understood as an economic policy aimed at reviving the contribution of industry to the country's economy, a priority increase in the level of development of material production based on a new technological order, which is characterized by the creation of computerized and automated productive forces and based on knowledge, vertical scientific and industrial integration and networks, where reindustrialization is interpreted as a synchronous process of creating high-tech sectors of the economy and effective innovative renewal of traditional industries, accompanied by qualitative changes in the technical, economic and socio-institutional spheres, based on interactive technological, social, political, managerial changes.

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