

Improving the principals of forming the strategy of the technological development for timber enterprises

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Abstract. Currently, the most of enterprises of the global timber industry undergo significant changes in their structure due to the introduction of new innovative technologies into production processes. As a result, the established production and cooperation ties are drastically transformed. Currently, little attention is paid to research into the issue of technological development of timber industry enterprises, as well as strategic management of this process. The purpose of this study is to elaborate the theoretical and methodological frameworks for the strategic management of technological development of timber enterprises. The methods of system, comparative and logical analysis, and scientific forecasting are used. The indicators of technological development of timber industry enterprises in the Krasnoyarsk Territory are analysed. The necessity for the medium- and long-term technological development strategy for a private enterprise of the timber industry is justified. The basic principles of forming a technological strategy development for private enterprises considering current trends in global timber industry are presented.

1. Introduction

At present, new innovative technologies are developing at a rapid pace, leading to a change in an established production cycle. Over the past few years, many innovative technologies and products have been introduced into the global timber industry that include but not limited to new forest growing technologies, paper production etc. In this regard, it is necessary to implement new methods in strategic management of technological development of timber enterprises. The most important element of the development management system of a forestry enterprise is a strategy of its technological development. The development of such strategy should follow the strictly defined principles. Previously in works [1, 2] the authors have proposed the theoretical basis on development such strategy to be used by specialists and enterprise management in the formation of a strategy for the technological development of private timber industry enterprises.

Information and communication technologies (ICTs) are widely used in wood-processing industries. Innovative ICTs can be effectively used by enterprises in relation to raw-material supply, processing, management and control, design and product development, and supply chain management [3]. For example, a relatively new product known as the cross-laminated timber (CLT) has revealed a significant potential for the use in construction [4]. The new biotechnologies also play a major role in the development of the global forest industry. The next generation of biorefinery products includes second-generation synthetic biodiesel, bioethanol, bio-heating oil and bioenergy (green electricity and heating). Wood components and chemical compounds are also used to make foodstuffs, pharmaceuticals and



cosmetics as well as structural components for entirely new materials [5]. Besides new production processes, the innovations have resulted in change in the structure itself of global forest industry [6, 7]. Such changes threaten the competitiveness of timber enterprises that base their activities solely on traditional, increasingly obsolete, industrial, and other technologies.

In a period of rapid changes in the technological image of the entire world industry, including the timber industry complex, researches are faced with the task of forecasting and managing the technological development of the timber industry enterprises.

At present, the global timber industry is primarily represented by large transnational corporations, which often concentrate the entire production cycle (from the process of growing the forest to the manufacturing the finished products) within its own organizational and production structure. Of course, large forest industry enterprises operating in several countries, pay considerable attention to the strategic development issues. To maintain the competitiveness, such enterprises use significant resources to ensure their own technological development, to constantly implement new forest products, to cooperate with scientific organizations to solve the strategic tasks of scientific and technological development. In the overwhelming majority of cases, the enterprises develop and implement appropriate strategies for technological development since it is the level of their technological development that is the basis for the competitiveness of their products. Given a high competition among the large enterprises in the timber industry, such strategies, as well as theoretical and methodological provisions for their development, remain inaccessible for familiarization with a wide range of information users. It should be noted that much work has traditionally been devoted to general issues of strategic enterprise management, starting from the middle of the 20th century to the present [8-10]. Also, quite extensively represented are works devoted to general trends in the technological development of the global industry, that is particularly considered in [11, 12].

Currently, due to the high value of forest resources for humanity, concerning the enterprises of the timber industry complex, issues related to their strategic management and technological development attract considerable attention of the world's scientific, political and business communities. So, in Finland, in 2015, the National Forest Strategy 2025 was developed [13]. In 2019, the National Forest Strategy 2025 was finalized. It examines the development goals of the state forest industry and the ways to achieve them. Considerable attention is also paid to the application of new technologies in the forest industry [14]. Many researched predict global structural and economic changes in the global forestry complex, which will affect the life of society as a whole [15, 16]. Technological changes in the global forest industry determine the creation of new jobs in it [17]. Increasingly widespread dissemination of innovative technologies is being adopted in the field of forest industry management [18].

At the same time, the issues of the formation of a strategy for the technological development of the timber industry complex are not considered in sufficient detail. In particular, in the scientific literature, there is not enough information on the issues of strategizing the technological development of enterprises of the timber industry complex. It should be assumed that for enterprises of the timber industry complex (especially small and medium), these issues are relevant, and therefore the management of such enterprises is interested in the scientific development of the issues identified.

Currently, innovative products and technologies are largely crowding out traditional goods and services in all industries, and therefore, the authors of this article consider it necessary to consider issues related to the formation of a technological strategy for the development of timber industry enterprises.

Considering the vastness of the issues that should be further developed by the scientific community in the future, the authors considered it expedient to develop the existing theoretical principles [1, 2] in one of the key issues of shaping a strategy for the technological development of forest industry enterprises – defining the principles for forming such strategies. As a result of the study, the authors presented a system of principles for forming a strategy for the technological development of forest enterprises, regardless of their type of activity, form of ownership and country of location. The results of the study can be used in further scientific research, as well as taken into account by the management of timber enterprises in the formation of appropriate strategies for technological development. The authors also analysed the indicators of the technological development level of the timber industry

enterprises of one of the most multi-forest regions of the Russian Federation - the Krasnoyarsk Territory. The results of the analysis of the technological development of the forest industry of the Krasnoyarsk Territory by the authors systematize the data of official state statistics and can be used by state authorities and / or investors to predict the development of the forest industry in this region.

2. Methodology

In terms of supplementing and transforming the theoretical principles for the formation of a strategy for the technological development of timber industry enterprises [1,2], the authors have carried out a systematic analysis of the scientific literature on general issues of strategic management of economic systems, general provisions on the technological development of economic systems, the formation of a strategy for the technological development of timber industry enterprises.

The principles for the formation of a strategy for the technological development of timber enterprises were determined based on the results of the transformation of existing theoretical concepts [1,2], and determined based on the results of using the following research methods as system analysis method, method of the logical method, and extrapolation method.

The analysis of indicators of the level of technological development of timber enterprises of the Krasnoyarsk Territory for some key types of economic activity was carried out based on materials available in the open access in the Federal State Statistics Service of the Russian Federation.

The authors presented the scientific results and the provisions obtained by them in the study of the activities of forest industry enterprises operating primarily on the territory of the Russian Federation, in particular, on the territory of the Krasnoyarsk Territory.

3. Forming the technological strategy of timber enterprises

3.1. Principals of formation of the technological development strategy

All participants of the global timber industry have a different level of their technological development. At the same time, the leaders of the technological development of the world timber industry complex pursue the goal of keeping their technological leadership from a strategic perspective. At the same time, for technologically less developed forest industry enterprises, the main strategic goal is to achieve the level of leaders in the technological development of the world timber industry complex and further competition with them. The solution of these tasks both for “technological leaders” and for “technological outsiders” of the world timber industry complex becomes possible only if the timber industry enterprises have the appropriate strategies for their technological development. At the same time, given the high level of competition in the technology sector, this strategy should take into account all the conditions affecting the technological development of a specific forest industry enterprise.

The formation of a strategy for the technological development of a timber industry enterprise should be carried out by all persons concerned with it (and who have the authority to do so) using basic, fundamental principles. The definition and development of these principles were one of the key objectives of this study.

As part of the global timber industry complex, many timber industry enterprises carry out various types of economic activity, produce various types of forest products, and also differ from each other in other ways. Given this circumstance, the authors presented a system of principles for the formation of a strategy for the technological development of a timber industry enterprise, which can be used in the formation of appropriate strategies for the majority of timber industry enterprises in the world, regardless of the existing qualitative differences between them. According to the authors, in the formation of a strategy for the technological development of a timber industry enterprise, interested parties should be guided by the following principles. The uniqueness of these principles of forming a strategy for the technological development of forest enterprises lies in the fact that, according to the authors, they can be used by any forest industry enterprises, regardless of their form of ownership and country of location.

3.1.1. The principle of consistency and interconnection. The strategy for the technological development of a timber enterprise is, in essence, one of the constituent parts of the overall development strategy of an enterprise for a long-term period. In this way, the management of a timber enterprise must take into account that the strategy of technological development developed by it must be systematically connected with all other strategic planning documents approved at the enterprise. At the same time, the specified strategy of technological development in conjunction with other strategic planning documents should form an effective system of strategic management of the development of a timber industry enterprise.

3.1.2. The principle of priority of introduction and reproduction of innovations. This principle assumes that the management of a timber industry enterprise in the process of shaping its technological development strategy should take into account the strategic goal of introducing the enterprise and further developing the system of creation and constant reproduction of innovative technologies within this enterprise. It should be borne in mind that the management of a timber enterprise in a strategic perspective must equally pay attention to both product and process innovations.

3.1.3. The principle of resource constraints. This principle implies that the strategy being developed for the technological development of a timber industry enterprise should be based solely on the financial, technological and other types of resources of the enterprise that are available and reliably predicted. If this principle is violated, the strategy being developed may become unrealistic in terms of its practical implementation.

3.1.4. The principle of priority of environmental safety. This principle requires the company to produce products with minimal harm to the environment (as well as a permanent reduction of the company's impact on the environment). It should be noted that this principle is generally accepted in all technologically developed countries and the issues of the environmental impact of timber enterprises are given considerable attention in many countries of the world [19]. In many countries, the environmental safety of the products of the timber industry enterprise and their production technologies is a prerequisite for the admission of such forest products to the domestic markets of these countries. At the same time, this principle is currently relevant, especially for the management of timber enterprises operating in developing countries. In most countries that are in a phase of rapid economic development, the profitability of the state's timber industry complex seems to be a more important goal for the leadership of such states compared to environmental standards in the production of timber products.

3.1.5. The principle of increasing shareholder value. This principle is based on the fact that, by its economic nature, the technological development of a private timber industry enterprise is subordinated, first of all, to the interests of its shareholders. At the same time, for most shareholders, the main goal of the enterprise's operation is to increase its shareholder value and its profitability. Thus, when developing a strategy for the technological development of a forest enterprise, its management should take into account that, along with the achievement of other goals, ultimately, the technological development of an enterprise should also lead to an increase in its shareholder value in a strategic perspective. Otherwise, the technological development of the timber industry enterprise will become inexpedient for its shareholders.

3.1.6. The principle of goal setting. The essence of this principle lies in the fact that the strategy of its technological development developed by the enterprise's management should define specific targets that the company must achieve by a certain period. At the same time, according to the authors, in developing appropriate strategies, it is advisable to establish intermediate targets for each of the specific stages of the strategy implementation.

3.1.7. The principle of accounting and use of the best world technological developments. In the context of global competition, the strategy being developed for the technological development of a timber industry enterprise should be based on current realities and trends in global technological development.

Neglect of this principle can lead the company to the loss of its competitiveness, for example, due to the emergence in the industry of the so-called "closing" technologies, after the appearance of which, the company may lose markets for its products. For example, at present, many experts predict rapid robotization of enterprises of the world timber industry complex, which should be taken into account by the management of enterprises when developing an appropriate strategy.

3.1.8. The principle of accounting resistance to technological development. When developing a strategy for the technological development of an enterprise, its management should take into account that external and internal forces will hinder the implementation of the strategy. In particular, such can be attributed to the competitors of the enterprise, part of its shareholders and other persons who have little interest in the technological development of the timber industry enterprise.

3.1.9. The principle of technological relevance. The developed strategy should fully comply with the global technological agenda and constantly maintain its relevance at each of the projected stages of its implementation. Leading scientists - economists of the world support the need to apply such an approach to the formation and implementation of the development strategy of the economic system (compliance of the strategy with external conditions) in various forms [20-22].

3.1.10. Principle of variability and feedback. It should be noted that at present, humanity is rapidly moving towards a singularity moment when the reliable prediction of further technological development will become impossible. At the same time, already at the moment, the adoption of a long-term strategy, which will be relevant for at least 15-20 years, seems unlikely. In this regard, when developing a strategy for the technological development of a timber industry enterprise, it should be borne in mind that the strategy being developed in the future under conditions of rapid change in technological reality may require prompt revision and change. Thus, this principle implies the need for the management of the timber enterprise to monitor technological changes occurring in the global industry continuously, as well as to get feedback on the results of the implementation of the relevant strategy. It seems logical that, if necessary, the management of the enterprise should be ready to make changes to the already developed and implemented strategy for technological development.

3.1.11. The principle of meeting the actual needs of the client. Currently, the entire global industry is ultimately subject to consumer demands. It should be noted that with the introduction of innovative technologies into the global industry, consumer demands tend to become more complex with the price of products remaining unchanged. At the same time, the competitiveness of an enterprise is largely determined by the competitiveness of its products. Thus, the technological development of a timber enterprise must also be subordinated to the current and forecasted needs of forest products consumers in the medium and long term. The application of this principle in the formation of a strategy for the technological development of a timber industry enterprise will make it possible to ensure the relevance of the company's product offerings on the markets in a strategic perspective.

3.1.12. Principle of limiting technological development. This principle implies that the management of a timber enterprise in the process of shaping its technological development strategy should plan for the largest possible number and highest quality of technological transformations that are only available to the enterprise (taking into account the existing resource constraints). It should be noted that this principle should be strictly consistent with the previously mentioned principle of resource constraints.

3.2. Technological development analysis of the regional timber industry (on the example of the Krasnoyarsk Territory)

To formulate the technological development strategy of a timber enterprise, the level of technological development of the region industry needs to be evaluated. In this study, it seems reasonable to the

authors to reflect the data characterizing the level of technological development of timber industry enterprises in the Krasnoyarsk Territory for 2017–2018.

Krasnoyarsk region is the second largest region of the Russian Federation in its area. The Krasnoyarsk Territory covers an area of 2,366,800 sq. km [23]. The timber industry complex of the Krasnoyarsk Territory plays a significant role in the economy of this region. For example, in 2017, exports of wood products and pulp and paper products from the Krasnoyarsk Territory accounted for 11.2% of the total exports of goods from this region [24]. Of course, the influence of the timber industry on the economy of the Krasnoyarsk Territory is because it is one of the most densely forested regions of Russia. Statistical data on the activities of forestry enterprises of the Krasnoyarsk Territory was obtained from official statistical information published by the Federal Service of State Statistics of the Russian Federation [24-26].

Krasnoyarsk Territory is one of the most wooded regions of Russia. As of 01/01/2018, the forest covered 45.1% of the region territory [25]. In the Krasnoyarsk Territory, 104.9 million hectares of land is covered with forest vegetation, 75.9% of which is represented by conifers, and 17.4% by soft-leaved tree species [25].

The number of organizations engaged in innovation activities in the Krasnoyarsk Territory in 2015 amounted to 90 units, in 2016 - 84 units, and in 2017 – 88 units. At the same time, in the indicated years, the level of innovation activity of enterprises of the Krasnoyarsk Territory was 8.8%, 7.1%, 7.1%, respectively. [25].

In 2019, 934 enterprises are operating on the territory of the Krasnoyarsk Territory with the main activity of «forestry and logging». It should be noted the decline of this indicator over the past two years. So, in 2017, this figure was 1066 units, and in 2018 - 952. At the same time, as a percentage of the number of all organizations in the Krasnoyarsk Territory, these enterprises make up 1.3%. The average number of employees of organizations with a type of economic activity "forestry and logging" in 2018 was 11,100,000 people, which is 1.1% of the total number of employees of organizations of the Krasnoyarsk Territory.

From 2016 to 2017, there was a sharp growth (almost 100%) in the indicator “the availability of fixed assets of commercial organizations” in the form of economic activity “forestry and logging.”. So, at the end of 2016, this figure amounted to 4742.2 million rubbles, and at the end of 2017 - already 9152.6 million rubbles [25], as indicated in Table 1. Table 1 is compiled according to the source [25].

Table 1. The presence of fixed assets of commercial organizations.

Organization type	2016		2017	
	million RUB	In % of the total volume of fixed assets of regional organizations	million RUB	In % of the total volume of fixed assets of regional organizations
Woodworking organizations	13.4	0.6	17.8	0.7
Organizations with the main economic activity "forestry and logging"	4742.2	0.2	9152.6	0.4

It should be noted the improvement in the indicators of the state and movement of fixed assets of these organizations with the main type of economic activity “forestry and logging”, as can be seen from Table 2. Table 2 is compiled according to the source [25]. So, the degree of wear from 2016 to 2017 decreased from 60.4% to 24.5%, while the coefficient of renewal of fixed assets increased from 14.1% in 2016 to 67.8% in 2017 [25]. These indicators characterize the improvement of the technological level of these enterprises according to the considered indicators. Attention should be paid to the sources of financing investments in the development of forestry and logging in 2017: the main source of such

funding was organizations' funds (67% of the total investment), and funds raised (33%), mainly due to bank loans [25].

In the woodworking sphere, as of 01/01/2019, 783 enterprises were registered in the Krasnoyarsk Territory. At the same time, the degree of depreciation of the fixed assets of these enterprises from 2016 to 2017 (at the end of the year) decreased from 43.0% to 37.7%, and the coefficient of renewal of fixed assets in the same period increased from 6.7% to the end of 2016 to 22.9% at the end of 2017 [25]. The above indicators, among others, are presented in Table 3. Table 3 is compiled according to the source [25].

The Krasnoyarsk Territory is experiencing serious problems with enterprises whose main economic activity is "Production of paper and paper products." So on 01/01/2019, in the Krasnoyarsk Territory, only 42 such enterprises were registered, with the average number of employees for them in 2018, totaling 126 people. At the same time, the condition of the fixed assets of such enterprises was characterized by depreciation by 60.2%, and their renovation rate was 4.1% [25].

It should also be noted that in 2018 there was no investment in the fixed capital of organizations producing paper, as well as the fact that in the period from 2016 to 2018 new facilities were not introduced at such enterprises. [25].

Table 2. The state and movement of fixed assets Krasnoyarsk Territory Timber Enterprises.

Organization type	Indicator	2016	2017
Organizations with the main economic activity, "forestry and logging."	Degree of wear (at the end of the year), %	60.4	24.5
	Update rate (per year), %	14.1	67.8
	Liquidation ratio (per year), %	2.3	1
Woodworking organizations	Degree of wear (at the end of the year), %	43	37,7
	Update rate (per year), %	6.7	22.9
	Liquidation ratio (per year), %	1.7	1.1

The considered values of indicators of the functioning of timber industry enterprises of the Krasnoyarsk Territory are presented in tables 1-3.

At the same time, the level of technological development of timber enterprises of the Krasnoyarsk Territory is also largely characterized by the fact that in 2018 Krasnoyarsk Territory the area of dead forest stands amounted to 102,600 ha, 49.4% of which died due to forest fires, and 49.8% were damaged by insect pests. Compared to 2017, in 2018, the volume of raw timber production increased by 6.5% and amounted to 14,300,000 dense m³ [25].

It should be noted that in 2017, Krasnoyarsk Territory produced 3,136,600 m³ of timber, longitudinally sawn or split, divided into layers or peeled, more than 6 mm thick, of wooden or tram sleepers, not impregnated. At the same time, the production of wood-fiber plates from wood or other lignified materials in 2017 amounted to 33,489,700 conditional m² [26]. It should be noted a significant volume of production in the Krasnoyarsk Territory of forest products of low degree of processing.

An analysis of the data examined suggests that, despite the significance of forest resources concentrated on the territory of the Krasnoyarsk Territory, at present the realization of their economic potential is not sufficiently effective, which is noted at the level of the Krasnoyarsk Territory authorities [27]. Over the past two years, the situation in the forest complex of the Krasnoyarsk Territory, according to the authors, has not changed significantly. Attention should be paid to the need to introduce in the Krasnoyarsk Territory new production facilities for the production of highly marginal products of the timber industry - paper and paper products. Also, the authorities of the Krasnoyarsk Territory should

pay considerable attention to the technological development of enterprises involved in the process of protecting the forests of the Krasnoyarsk Territory.

The results of the analysis of the technological development of the forest industry of the Krasnoyarsk Territory by the authors systematize the data of official state statistics and can be used by state authorities and / or investors to predict the development of the forest industry in this region.

Table 3. Key performance indicators of enterprises of the timber industry complex of the Krasnoyarsk Territory (by economic activity) in 2017.

Type of economic activity	Volume of shipped goods of own production, work performed and services on their own), million RUB	Production Index, % of the previous year	The average number of employees, people	Net financial result (profit minus loss), million RUB	Profitability of goods sold, products (works, services) of organizations, %
Wood processing and manufacture of wood and cork products (except furniture, manufacture of products from straw and materials for weaving)	27014.4	117.6	9046	-2235.42	0
Manufacture of paper and paper products	589.6	120.8	120.8	0.5	-8.9
Furniture manufacture	3084.6	112.7	1600	15.7	6.3

4. Conclusion

In this study, the authors presented an analysis of indicators of the level of technological development of timber industry enterprises of the Krasnoyarsk Territory for the period 2016 - 2019. Main indicators are presented in tables 1, 2, 3. The analysis of these indicators made it possible to identify the main problems in the field of technological development of timber industry enterprises of the Krasnoyarsk Territory and to provide recommendations for solving them. Also, the authors reviewed the principles they proposed for the formation of a strategy for the technological development of timber enterprises. It should be noted that these principles are general and their practical application should be made by the management of enterprises, taking into account the actual circumstances of the enterprise, market conditions and other factors affecting the process of technological development of a specific forest industry enterprise.

It should be noted that the theoretical and methodological provisions on the formation of a strategy for the technological development of timber enterprises require further development. So, given a large number of technologies and equipment used at forestry enterprises, the issues of assessing the level of technological development of a timber industry enterprise are of considerable scientific interest. Despite the available developments in this area, this issue may be the subject of further research.

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