The knowledge economy as the basis for innovative development of the Russian forest sector

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Abstract. The Russian forest sector is now undergoing global changes related to the development of digitalization and innovation. Raising the innovation level is a strategically important task for the country. It depends on the conditions created for the development of intellectual resources. Forest is a natural capital, partially forming the country's national wealth. Russia occupies leading positions in the world forest yield. Attraction of innovation to the forest sector is the urgent task. For a long time, forest sector was unattractive for businesses and investors due to the long cultivation cycle, natural risks and large fire losses. Here innovations should come to rescue. They enable to automate biological processes and gain progress in productivity growth. Innovations should not be borrowed technologies, but created using our own resources. Today, scientists from Germany, Italy, and Costa Rica are looking for different approaches increasing forestry innovative potential. We propose to use knowledge for innovative development of the forest sector: there is a direct relationship between the levels of innovative activity and education. The aim of this article is to create instruments for the forestry innovative development, based on the knowledge economy, leading to the innovation formation.

1. Introduction
A number of reasons, such as Russia's accession to the World Trade Organization in 2012 and the sanctions impact in the period 2014–2018 of leading world countries (28 EU members and five non-European countries: Australia, Canada, USA, New Zealand, Japan) led to a significant displacement of inefficient domestic producers from traditional domestic and global markets. As a result, the factors ensuring the competitiveness of products and technologies on the basis of innovation activity have become the subject of attention for scientists and practitioners [1]. According to the Federal State Statistics Service agency, the contribution of the forest sector to Russia's GDP is estimated at only about 1.2%. It indicates a weak performance of the sector as a whole. Along with this, it has a powerful resource potential. It is necessary to develop scientific developments and innovative proposals as the basis for the innovative development of the forest sector.

Starting to explore this area, we need to note that more than 20% of all the forests of the planet are in Russia. This is many times more than in the leading timber industry countries of the world: the USA, Canada, China, Sweden, and Finland. Russia's share in the global timber industry market is only 3% due to irrational use of the resources. More than 50% of exports are low-value-added products: round wood and sawn timber. Russia is lagging behind (share in pulp exports is only 4%) with regard to high value-added timber processing products [2].
Forest sector is strategically important for the Russian economy, as it is evidenced by the Presidential Decree No. 204 of May 7, 2018 “On National Objectives and Strategic Development Goals of the Russian Federation for the Period until 2024”, the national project “Ecology”, and the federal project “Forest Conservation”.

Russia reached the first place in the world in terms of yield (129 billion m$^3$), being ahead of Brazil (120 billion m$^3$) according to the results of the state forest inventory conducted in 2018.

So, based on the above, it is clear that forest is a national wealth of Russia. It is the basis of economic development [3].

Issues of innovative development of the forest sector are relevant not only in Russia. We have analyzed the world studies of a number of scientists in recent years. It is obvious that the processes of global digitalization are forcing to seek new approaches to the innovative development of the forest sector [4]. For example, researchers from Germany propose to use approaches based on the Foresight methodology as promising tools for managing the innovative development of the forest sector in the field of forest management (for example, wood production, nature conservation and recreation) [5]. Italian experts see a multi-level perspective for the innovative development of the forest sector based on sustainable bio-economics tools. They apply the methodology of SWOT analysis to identify strengths and weaknesses, opportunities and threats of the forest sector [6]. Scientists from Costa Rica model a toolkit for innovative, competitive development of the forest sector based on a learning economy. They propose (as a methodology) to introduce and institutionalize knowledge in forest management processes, but not only their own, but also acquired from outside [7].

So, the connection between innovation and knowledge is undeniable. At the same time, the knowledge economy is capable of building a single technological chain from the use of knowledge to the creation of innovation. Thus, innovation becomes one of the characteristics of the knowledge economy. Information is transformed into codified knowledge, and then into innovative ideas that underpin the creation of innovative technologies.

We propose to use a knowledge-based economy because innovation is one of its characteristics. Our aim is to create tools for the innovative development of the forest sector based on the knowledge economy.

2. Methodology

The methodological approach to the instrument formation for the innovative development of the forest sector based on the knowledge economy includes two stages. The first stage is an assessment of the forest sector as a part of the country's national wealth. The second stage is an assessment of the innovative potential of the forest sector through the Russian Knowledge Economy Index. This methodological approach is based on the main aspects of classical and modern methodology. We consider the methodology for assessing national wealth in the context of innovative development of the forest sector.

The most significant and internationally recognized are the results obtained by St. Petersburg scientists in the field of management methodology and multidimensional analysis of national wealth. They consider it as a prospect for sustainable economic development.

According to Prof. K. Kondratyev research, after the information and technological revolution of the last decade, a real opportunity arose to identify deep long-term trends in the formation and use of national wealth as one of the foundations and objects of sustainable innovative development management.

In our study, we use the World Bank methodology as the basis for assessing the forest sector as a national wealth. Here, national wealth is estimated by three types of capital: industrial, reproducible by man (fixed assets, working capital), human, intangible (licenses for inventions, know-how, etc.), natural (land, mineral reserves, natural biological and water resources). Figure 1 shows the data presented by the Federal State Statistics Service of the Russian Federation for 2017.

In our study we take the World Bank’s methodology as a basis, according to which national wealth is estimated by three types of capital: production, reproducible by man (fixed assets, working capital), human, intangible (licenses for inventions, know-how, etc.), and natural (land, mineral reserves, natural biological and water resources). Figure 1 shows the data presented by the Federal State Statistics Service of the Russian Federation for 2017.
According to the audit and consulting company FBK (Institute of Strategic Analysis) in 2017, the share of the forest sector (industrial and non-industrial forest) in the structure of the national wealth of Russia was 2.7%, while the share of mining (2.7%) was 10.1%. Based on the assumptions of the national wealth reproduction, the forest sector can be considered as a capital, covering various assets. Sustainable development of the forest sector and the effectiveness of the national economy depend on the rational management of such assets.

Next, we consider the basic methodology for assessing innovative potential, in relation to the forest sector which is a part of Russia's national wealth.

According to the representative of the classical methodology K. Freeman, the assessment of innovative potential is a system of measures for the development, operation of production, economic, social, organizational potential that underlies innovation. Russian researcher Morkovina S S suggests paying special attention to the selection of criteria used for the long-term prospects of innovation development [8]. Agreeing with F Hayek, we note that institutional aspect is very important in relation to assessing the innovative activity of the potential of the forest sector. It is very important due to the fact that significant problems are associated with the imperfection of institutions and lack of modern innovative technology [9].

A modern methodology for assessing and comparing innovation activity developed by the researchers at the INSEAD International Business School and the World Intellectual Property Organization (WIPO) offers the calculation of the Global Innovation Index as a complete set of innovative development indicators. At the end of 2016, Russia occupied the 62nd place out of 142 possible in the ranking of countries in terms of the innovation development (loss of 11 points compared to 2015) [10].

The primary problem hindering the effective development of innovations in Russia is borrowing of innovative technologies, but not the development of our own. The level of “passive technological borrowings” in our country is 34.3% according to 2017 compared to 5–8% in the developed countries [12]. The forest sector is not an exception. The problem is the lack of staff due to the low growth of qualified specialists (3.6% per year), which does not meet the needs of the forest sector. Thus, there is an obvious link and direct relationship between the level of innovation activity and the level of education. Russia was ranked 49th (the data for 2017), according to the Education Index. It is calculated by the United Nations Development Program (UNDP) [11].

The Knowledge Economy Index characterizes the level of innovation processes in the development of a knowledge-based economy. The Index reflects Russia’s 55th place in the world using the World Bank’s methodology. This indicates the country's low ability to create, accept and disseminate knowledge, as well as to use this knowledge for economic development.

Thus, based on the above, the development vector in the modern world is biased towards innovative development, intellectual production, professional knowledge and skills. As a result, the development of a knowledge-based economy will ensure a rapid transition to the sixth technological order. As a result, the development of the knowledge economy will increase innovative potential of the forest sector.
3. Results and discussion

Three main problems of innovative development are selected, based on the methodology described above. The first problem is that the institutional environment is not keeping pace with changes in the forest sector. In particular, improving the culture of forest management, development and monitoring of compliance with environmental standards of management, reducing the share of gray market. Then it is restoration of the educational and scientific base of the industry, etc. For example, the Accounts Chamber of the Russian Federation revealed damage from illegal logging to the amount of 11.9 billion rubles by the end of 2016.

This problem must be solved by identifying deep long-term trends in the use of national wealth as one of the foundations and objects of managing sustainable innovative development of the forest sector.

The second problem arose due to the lack of financial resources. It leads to a slowdown in the innovative development of the forest sector. In Russia, innovations in the forest sector can arise only in research centers (universities). Companies developing new products and technologies do not have their own funds to create their own research centers. According to the timber industry, attracting startups is a promising mechanism that enables to "catch" interesting, unique ideas. In the fall of 2018, the Ilim Group launched a search for startups based on the GenerationS corporate accelerator from RVC (Russian Venture Company). Directions for applications in the forest sector included: forest logistics, Digital, AI, pharmaceuticals, packaging, new materials based on cellulose, paper and cardboard.

Investment activity in the forest sector is very low. First of all, this is due to low indicators of knowledge, the lack of preferential credit rates for producers and long financial assistance in implementing priority investment projects (the so-called long-term money in the late stages). The general dynamics of the volume and number of investments in the Russian economy (including the forest sector) is presented in figure 2.

![Figure 2. Investments in the Russian economy, including the forest sector.](image)

It should be noted that investments in the early stages (VC investments) tend to decrease by 50.3% during the period from 2014 to 2017. Mature investments (PE investments) tend to grow by 17.3% between 2014 and 2017.

The data (figure 3) indicate the unstable dynamics of active PE investments. Jumps are observed every year (from 9% in 2014 to 24% in 2015; from 4% in 2016 to 17% in 2017). This is due to the difficult economic situation in the country, the inaccessibility of foreign investment.

Investments in the early stages also have an unstable trend (from 91% in 2014 to 76% in 2015; from 96% in 2016 to 83% in 2017). It is connected with the lack of knowledge, and, consequently, of innovative ideas.

The third problem of innovative backwardness of the forest sector is the lack of trust between the state and business. The problem finds its expression in the low stimulation of domestic demand and inactive participation of young professionals due to the lack of innovative development and high-tech business.
Figure 3. Ratios of PE and VC investments in the forest sector of the Russian economy.

So, based on the above, the potential of the Russian forest sector can be fully realized by increasing the investment attractiveness and reducing the technological gap. The instruments of innovative development of the forest sector based on the knowledge economy will solve a number of key problems of the forest sector (figure 4).

Figure 4. Instrument for the development of innovative activity in the forest sector based on knowledge approach.

This instrument is a comprehensive plan for the innovative development of the forest sector, which includes innovative strategy and strategy for scientific and technological development. At the same time, the state should take the role of a compensator for the riskiness of investments in innovative activities. It becomes a participant in the creation of an innovative product. The parallel influence is rendered by digitalization in Russia. Only teams of programmers (specifically focused on the forest sector) and
employees (who have special knowledge of the forest industry and know the forest management processes) can solve the problems of forest sector automating [12]. In these conditions, innovative development takes on a qualitatively new character. A number of authors believe that a transition to the new mode of production takes place. For example, Dr. R. Tolstyakov calls it the information mode of production. Dr. V. Muravyev suggests the most interesting approach. He believes that innovative production is a computer-technological method of production, since information technology completely rebuilt it.

But the question of forest use and conservation is of practically no interest to young people, since they are not involved in this area and, as a result, they are not interested in turning the forest sector into a high-tech business. In this situation it is necessary to launch innovative organizations in order to link the market for innovation proposals to cause and effect relationships with the market for innovation consumption. That is to eliminate the lack of innovative projects and attract young people. To this end, it is necessary to create modern structures with the maximum involvement of students. It should be done through the formation of scientific and technological centers at major universities, as well as business incubators and industrial parks. It is worth highlighting the opinion of D L Evans who noted that the progress of science and technology, defined the “new economy” [13]. This largely happened in connection with the spread of the Internet.

As a result, the instrument for development of forest sector innovation activity (based on the knowledge approach) enables to solve a number of urgent problems, namely: the choice of strategic direction of the innovation development of the forest sector will be clearly defined and a favorable environment for innovation will be created on the basis of the knowledge economy; access to long-term money will be provided (at later stages of project development); investment access will be provided; R & D tax support will be provided; a new technology training system will be created and a risk culture will be formed.

So, the acceleration of innovations and innovative activity of the forest sector leads to the strengthening of their influence on the economic development of Russia. The economic effect of the spread of the fifth technological mode (dominating today) will reach a peak by the middle of the second decade of the current century. Over the same time, the general outlines of the new, sixth technological mode will be formed. Russia, thanks to its potential and knowledge economy, will be able to reach the leading positions of the world markets in this field of research.

4. Conclusions and recommendations

This article reflects the creation of instruments for the innovative development of the forest sector based on the knowledge economy. Based on the results of the study, it can be concluded that interest in the forest sector will arise with the advent of technology companies. They can, together with foresters, control the full cycle of forest growing. By applying the knowledge economy, the forest sector will cope with the intense flow of data from various sources. This will allow receiving information of a new quality, finding patterns, creating added value for all the involved participants, and applying modern data processing methods. Management decisions made on the basis of new information will lead to innovative development of the forest sector.

A new innovative wave opens up excellent opportunities for Russia for innovation break-through and growth of its share in the global forest market structure. It is possible in the nearest future due to the development conditions of the knowledge economy, which is acquiring a qualitatively new character.

At the same time, innovation, as a process of creation, distribution and using innovations, is transformed into a center of qualitative, quantitative and structural changes. The innovation process is a continuous, ongoing factor. The speed of changes in the economy is unprecedentedly high, which ensures that the institutional environment is in line with changes in the forest sector.

The use of tools for the development of innovative activity in the forest sector, based on a knowledgeable approach, enables in future [14], firstly, to shift the balance from physical to mental activity, thereby transferring an ever-increasing share of innovation activity to a new quality, then, to overcome the division of knowledge and skills in economic society [15], and finally, to acquire the ability to conduct activities in real time being in geographically remote locations.

The formed instrument (helping to uncover the essence of the knowledge economy) is that “... any innovation (whether technological or institutional) creates prerequisites for new innovations, thereby inducing a chain reaction of innovations,” defining it as an innovative, most fruitful one, allowing to focus on its key attribute - the level of human capital development, which will be a key factor.
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