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# Digitalization Roadmap of the Russian Forestry and the Risks of Its Implementation

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***Abstract---*** *Currently, digital technologies develop exponentially. Support for this process is provided at the state level in many countries. Russia has adopted program documents for the digitization of the country and the development of the forestry, which should be observed from a unified systemic position, taking into account not only the interests of the state, but also the ones of business. We tried to consider the problems of the development of only one Russian industrial sector, the forestry, and how digitalization can help to solve these problems. We also tried to make an analysis of the risks arising in the industry on the way of its transformation. It is revealed that the Russian economy, in general, has the potential for the digital transformations. There is also the desire to achieve results. However, the source of risks for forestry lies in the lagging behind the world level of the main Russian technologies used in the forestry.*

***Keywords---*** *Russia, Forestry, Digitalization, Roadmap, Risks.*

## I. INTRODUCTION

Today, there is much talk about the existence of a trend to dramatically increase the role of new technologies, including digital ones, in people's lives, in the global economy (Digital Economy and its development paths, 2018).

We can already formulate the content of the concept “digital economy”, for which the terms “web economics” and “electronic economics” are also used (Electronic economics, 2019). Digital economy is an economy based on the use of electronic, digital, information and communication technologies. A detailed analysis of various interpretations of the concept “digital economy” is given, for example, by R. Bukht and R. Hicks (Bukht, R. et al., 2018, pp.146-155)

Perhaps (Kozyrev 2018, p. 6) as the best-known scientific study of the digital economy should be considered the book of Don Tapscott (Tapscott, 1995; Tapscott, 2014).

Among the most important outcomes of digitalization, Tapscott finds, referring to the theory of the firm of Ronald Coase (Coase, 1937), the possibility to dramatically reduce transaction costs, primarily the costs of searching for information and signing the contracts. His main conclusion is the transfer of business from traditional firms to the media exists (television, radio, cinema, press, etc.).

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A.N. Kozyrev, considering the digitalization process in a historical aspect, shows how the efficiency of digital technologies grows over time, it quickly captures the entire media sphere, and then begin to penetrate into various industries, including energy, construction and transport (Kozyrev, 2018, p. 6).

Development programs for individual industries should be coordinated with the digitalization program in the Russian Federation. This also applies to the Russian forestry. However, some Russian authors note the lack of systemic character of the program “Digital Economy of the Russian Federation”, insufficient coherence with other programs of the National Technology Initiative, which is funded from the state budget (Kapranova, 2018, p. 68).

In this article we are trying to present how the problems of the Russian forestry can be solved with the help of the digital technologies introduction. At the same time, we relied on the views on digitalization that have been formed today, and which may be important for the transformation of the Russian forestry. The tasks for the forestry digitalization are stated in the system of general development goals of the country as well as in the Russian forestry development program.

## II. MATERIALS AND METHODS

The study of the digitalization directions for the Russian forestry was realized in the following way.

Firstly, we made a brief analysis of the prospects for digitalization of the economy and how these prospects are seen in Russia and other countries.

Then, the main threats to the forestry were examined, finding out how the transformation of the industry can help to overcome these threats. For comparison, an analysis of the situation in the fuel and energy complex of the country was also performed.

To identify the changes that can serve for the development of the forestry, the directions of digital development formulated in relation to the country's economy, as well as relevant tasks with timing for their implementation, were studied. These tasks are divided into two parts: some are of a general nature, do not need clarification with respect to forestry and their content is formulated in accordance with the Russian digitalization program. Their solution creates an environment of digitalization for the forestry economy (Program, 2017). The content of other tasks is clarified and disclosed as a tool for solving companion problems of the forestry. Some of them are formulated in accordance with the decree of the Government of the Russian Federation, approving the strategy for the development of the forestry (Strategy, 2018). Others are formulated by the authors, basing on the analysis of the published literature. State institutions and forest companies may be interested in solving such problems.

In our opinion, the study of the forestry problems in the overall system of digital development of the country makes it possible to compare the tasks of different levels of management and helps to create an institutional mechanism for determining the needs of economic sectors in applying the technologies in the digital economy and organizing the monitoring of research and development.

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## III. RESULTS

Experts give various quantitative forecasts of the prospects for the development of the digital economy.

As estimates R. Bukht and R. Hicks (Bukht R. et al. 2018, p.158), the size of the digital economy has 5% of the world's GDP. By 2025, only recruiting and personnel platforms will reach a total turnover of 2.7 trillion dollars - about 2% of the world's GDP (11. Manyika et al., 2015). R. Bukht and R. Hicks also noted the unevenness of the digital economy and its growth rates: if the global North has an advantage in its distribution today, then the growth rates are higher in the global South. Moreover, in general, the growth rate of the digital economy exceeds that of the traditional economy.

The Draft Recommendations of the Task Force B20 states that by 2025, cross-border data flows could reach 20 trillion US dollars (Draft Recommendations of Task Force B20, 2018).

Specialists from Huawei company, basing on the analysis of the accelerating processes for developing business models, products and services of a completely new format, give an even more optimistic forecast, suggesting that the volume of the digital economy by 2025 will presumably exceed 23 trillion US dollars (USA, Global Networking Index for 2018, 2018).

In total, in the period 2015-2030, investments in the global economy will amount to about 300–400 trillion US dollars. From this sum, about 90 trillion US dollars (about 6 trillion US dollars per year) are likely to be invested in the city's infrastructure, land use and energy systems (GCEC 2014).

Recognition of the importance of the digital economy role is proved by an annual increase in its share in global GDP by almost 18%, and in developed countries by 7%. According to the World Bank, an increase in the number of high-speed Internet users by 10% could increase annual GDP growth from 0.4 to 1.4% (The World Bank, 2016).

A. Shokhin, president of the Russian Union of Industrialists and Entrepreneurs, analyzing McKinsey estimates (the total investment requirement for infrastructure development is about 93 trillion US dollars), notes that about 40 trillion dollars are required for energy, 27 trillion dollars - for transport, 19 trillion dollars - for water supply and waste treatment, 7 trillion dollars - for telecommunications. At the same time, basing on the analysis of trends, he assumes that infrastructure investments will amount to 47 trillion dollars (Digitalization is the engine of growth and inclusive development, 2018).

Russia has adopted a program for the development of the digital economy (Program, 2017), which indicates a great interest of the country's leaders in this topic ("Digital Economy" as a window of opportunity for investment in Russia, 2017).

In the materials on the national project "Digital Economy", published on the website of the Government, the budget of the Russian national project "Digital Economy" for the years 2019-2024 is set at 1.63 trillion rubles. The national project should receive 1.1 trillion rubles from the federal budget. Proceeds from extrabudgetary sources will amount to 535.3 billion rubles (the budget of the national project "Digital Economy" by 2024 will amount to 1.63 trillion rubles, 2019).

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In December, 2018, Russian Prime Minister D. Medvedev estimated the funding for the national program for the digital economy for 2019–2024 in more than 1.8 trillion rubles, noting that more than a trillion of these sums are funds from the federal budget (Russian Federation will spend almost 2 trillion rubles for the development program of the digital economy, 2018; Volkov V.I., 2017, p. 109).

The volume of private investment in end-to-end digital technologies in Russia should reach 120 billion rubles by the end of 2021. By the end of 2020, it is planned that leading companies will implement a portfolio of projects to develop technologies and platform solutions with a total funding of at least 10 billion rubles. Until the end of 2021, a digital platform for research and development on end-to-end technologies will be created in Russia. It is expected that by 2022, 1,350 commercially oriented science and technology projects in the field of end-to-end technologies will receive grant support.

By the end of 2023, 50 accelerated training centers should be set up in Russia together with companies of the digital economy. By 2021, five centers should be open, by 2022 they should reach the number of fifteen.

Experts point out that the spread and development of the digital economy is uneven both in countries and in economic sectors. Moreover, every industry and even, perhaps, every enterprise should independently formulate its attitude towards digitalization, outline its own ways of its implementation. The digital economy is not limited to the information and communication technology sector or to digital companies. It is argued that digitization will have a large effect in all sectors of the economy (UNCTAD. World Investment Report, 2017).

The experience of industries with high capital intensity can be used for the forestry. Therefore, firstly, we assess the effectiveness of digitalization in Russia using the example of overcoming threats by the country's leading oil and gas industry.

It is known that oil and gas reserves are gradually being depleted, consequently, the share of hard-to-recover hydrocarbons is growing. Therefore, in the oil and gas industry, work is being done to increase the number of fields that are optimally managed, using formal models to rationalize costs and regulate geological risks. Such technologies appeared in the Russian Federation in the late 2000s with the advent of Shell and BP. Today in Russia, the oil fields that are managed in that way are more than 40, they produce about 140 million tons of oil, which is about 25% of all oil production in Russia (mainly hard-to-recover hydrocarbons and shelf).

In the case of solving the digitalization problems in Russia, about 720 million tons of oil and condensate can be produced by 2035. Pipeline restrictions will reduce this amount to 607 million tons. If the technologies do not change, then production will be only 520 million tons.

According to forecasts of Vygon Consulting, the digitization of the Russian oil and gas industry will require 24 trillion rubles by 2035 with an annual return of 6.5 trillion rubles. However, to solve this problem, it is necessary to develop oil-producing technologies. But at the same time, there are risks that the required pace of development cannot be sustained due to the threat of new sanctions and insufficient import substitution rate (24 trillion rubles until 2035 will require digital transformation in the oil and gas industry of Russia, 2018).

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Deloitte experts have proposed a roadmap for the digital transformation of oil and gas production technologies (A. Mittal, E. Slaughter, V. Bansal, 2017). Let us consider the interpretation of this approach for the forestry in the digitalization system of the Russian economy.

We will try to find out what changes can serve the development of the industry, considering the possible areas for the Russian forestry digitalization.

In 2018, Russia adopted a strategy for the development of the forestry until 2030 (Strategy, 2018). In the context of this program, we would like to study the question of the consequences that digitalization of the economy may have for the forestry.

The forestry consists of 2 main economic areas: forest management and forest industry.

Forest management is an industry that implements a system of measures aimed at reproducing forests, protecting them from fires, pests and other negative factors, regulating the use of forests and accounting forest resources, in order to meet the economic needs of wood and other forest products, while maintaining environmental and social functions of the forest.

The forest industry is a combination of industries that harvest and process wood, produce wood products through chemical and mechanical processing of finished products with various degrees of technological complexity. The forest industry branches include: timber, pulp and paper industries, the production of lumber, wood-based panels, plywood, furniture, biofuels, wooden house-building and forest chemistry (production of rosin, tall oil, etc.). The forest industry produces such products as furniture, paper, cardboard and building materials.

In modern conditions, the activities of complex industrial production associations and complexes cannot be organized without a sufficient degree of the action plan elaboration and long-term forecasting. The priority in planning is to identify the tasks that must be accomplished in order to achieve the set goals. These tasks are combined into a plan containing the implementation dates.

Transformation of forestry in the conditions of transition to a digital system of support and functioning is a complex and laborious process that needs to be planned. Here the plan of the tasks for the forestry, integrated into the development of the entire economy of the country, which determines its description as part of the overall program of the digital economy. On this basis, the formation of a plan for the development of the forestry should correspond to the tasks contained in the program of the Digital Economy of Russia (9. Program, 2017), and not contradict the general vector, being aimed at achieving the goals and results expected from the implementation of this program. The program of the Digital Economy of Russia contains the basics of digitalization development, where, according to the five main areas of development, a plan is presented for obtaining certain results in the field of transformation of the Russian economy that are necessary to achieve specific program milestones. The “roadmap” of managing the development of the digital economy consists of three main stages, and is broken down into time periods: 2018; 2020; and 2024. For each of the stages, the plan for achievement of the goal state of development for

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each direction is provided. Each of the directions contains its own tasks and timelines for their implementation, with an indication of specific results to be achieved.

The Strategy lists the main problems of the forestry:

- Low harvest of wood from the area of forest exploitation due to insufficient maintenance of the forests;
- Low efficiency of restoration and protection of forests (losses from fires, pests, etc., are significantly higher than the costs for countering threats);
- Excessive bureaucratic obstacles, first of all, when addressing issues of identifying priority projects and environmental protection;
- Insufficient level of wood processing due to insufficient capacities for processing of low-grade raw materials and low potential for the development of the Russian market for high-value-added products;
- Unattractiveness of the industry for investors, caused by low ratings of the country as a consumer of investments, bureaucratic barriers in the implementation of investment projects, infrastructural underdevelopment;
- Low level of technical, scientific and personnel support (high moral and physical depreciation of equipment and technological dependence on imports, lack of special education of more than 75% of workers in the industry, low level of funds for the forest problems study, which is less than 0.1% of the forestry GDP);
- Imperfection of the legal framework in the industry and related sectors, manifested in issues of identifying the priority of projects and relations in the exploitation of forest resources by investors, as well as encouraging improvement in the quality of forest management.

When planning the transformation of the forestry, it is required to draw up a list of tasks that will take into account the needs of the forestry, and at the same time be coordinated with the goal state in each direction of the digitization of the country's economy and meet the set deadlines.

For the above-mentioned goal, the structure of the tasks for the development of the forestry in the digital economy has been developed. Figures from 1 to 3 show the structures of the tasks for the development of the forestry for 2024, 2020, and 2018 and the corresponding structures of the general tasks of the economy.

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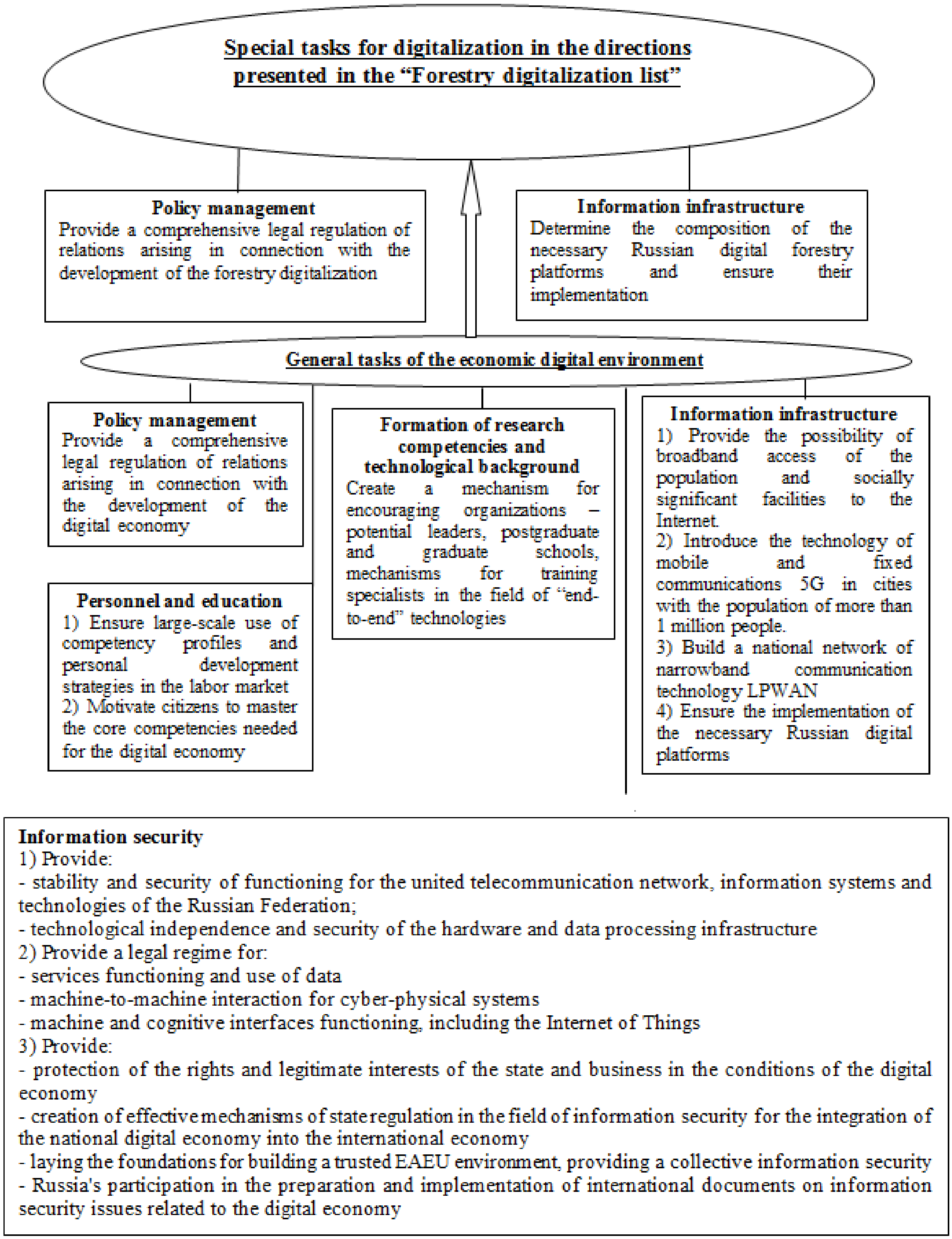


Source: author's development

Figure 1: The system of tasks for the forestry transformation by 2024

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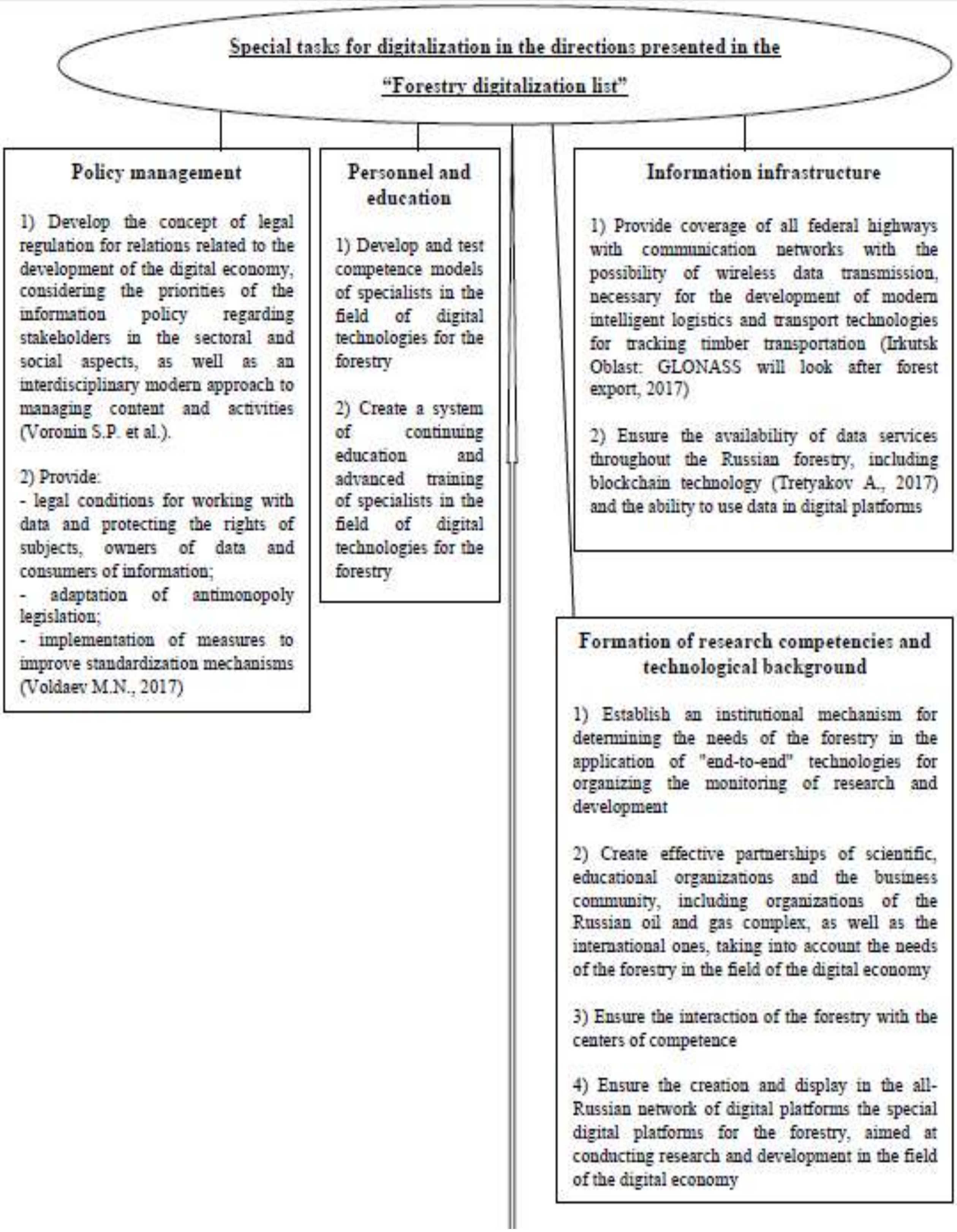


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## General tasks of the economic digital environment

### Policy management

1) Develop a concept of legal regulation of relations arising in connection with the development of the digital economy
2) Provide legal conditions for:
- working with data and protecting the rights of subjects, owners of data and consumers of information;
- effective use of the intellectual property
- introduction and use of innovative technologies in the financial market
- implementation and use of decentralized register management and certification of rights
- the introduction of new rules for collecting reports, eliminating duplication, providing its remote reception and meeting the data needs of society and state in real-time
- functioning of legal regimes that create conditions for the priority activities of the digital economy, including economic activities for the collection and use of data
3) Adapt antimonopoly legislation for the needs of the forestry
4) Adopt regulations to stimulate the development of the forestry
5) Improve the standardization mechanisms to ensure the compliance of the technical regulation system and the uniformity of measurements with the objectives of the digital economy, including development of a regulatory framework and a library of standards for priority areas in a machine-readable format
6) Sign international agreements, adopt regulatory and technical documents, promoting the development of the digital economy in the EAEU
7) Adopt methodological documents for the development of competencies of persons involved in the preparation, adoption and application of normative legal acts in the field of the digital economy

### Personnel and education

1) Develop competency models for the interaction of society, business, the labor market and education for the digital economy
2) Develop a mechanism for independent certification of competences in the education system and the labor market for the digital economy
3) Create a format of individual profiles of citizens' competencies and their development trajectories, determining the rules for access to this information
4) Introduce into the education system the requirements for the core competencies for each level of education, ensuring their continuity
5) Ensure the work of the general education system of citizens for the digital economy
6) Ensure the work of the systems of general, vocational and additional education of citizens for the conditions of the digital economy
7) Introduce a regulatory framework for the labor and social relations with flexible and distance employment
8) Motivate companies to create jobs and train citizens for the competences needed in the digital economy
9) Motivate foreign citizens to participate in the development of the digital economy

### Formation of research competencies and technological background

1) Establish an institutional mechanism for determining the needs of the economic sectors in applying "end-to-end" technologies for organizing the monitoring of research and development in the field of the digital economy
2) Create partnerships of scientific, educational organizations and business for development in the field of the digital economy
3) Create competence centers for expert support in conducting and commercializing developments
4) Create a network of digital platforms for development in the field of the digital economy

### Information infrastructure

1) Provide broadband access to the Internet network of state and self-governing bodies
2) Provide coverage of federal highways with wireless data transmission networks for modern intellectual logistic and transport technologies
3) Ensure the storage and processing of data throughout Russia for citizens, business and government
4) Ensure the storage and processing of all information, created by the state and self-governing bodies, in the state unified cloud platform
5) Ensure data can be used in digital platforms
6) Create local digital platforms for collecting, processing and disseminating data in the interests of citizens, business and government:
- for the needs of cartography and geodesy,
- for remote exploration of the Earth (project "Digital Earth" from space)

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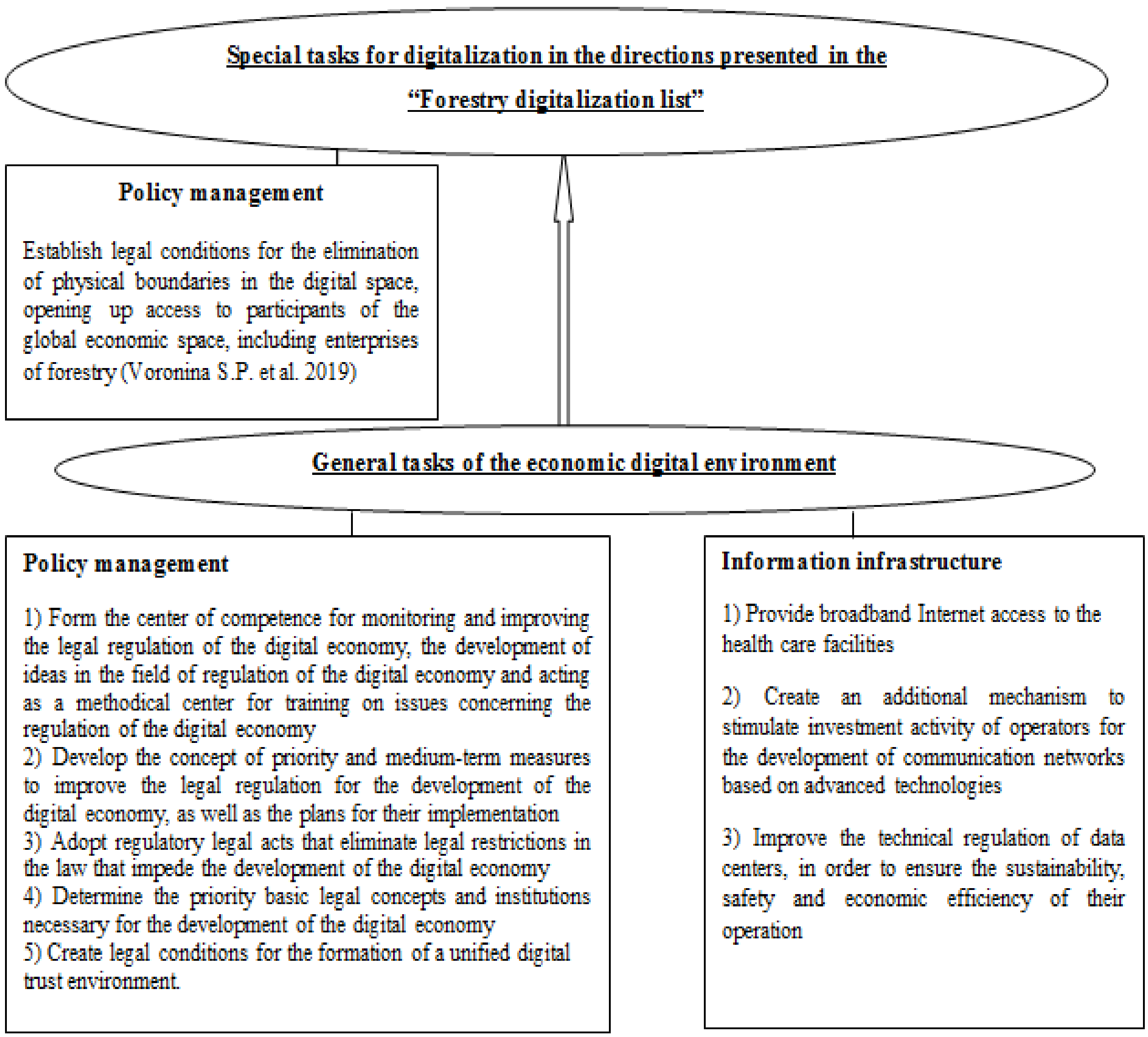
**Information security**

1) Ensure the manageability and reliability of the Russian segment of the Internet
2) Ensure the protection of the rights, freedoms and legitimate interests of the individual in the context of the digital economy
3) Create technical tools to ensure safe informational interaction of citizens in the context of the digital economy

Source: author's development

Figure 2: The System of Tasks for the Forestry Transformation by 2020




Source: author's development

Figure 3: The System of Tasks for the Forestry Transformation by 2018

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***Forestry Digitalization List***

***1. Directions of digitalization in the interests of state for the control of the forestry***

General directions:

- Accounting of wood and bargains with it (Voldaev, 2017);
- Development of the system for maintaining the state register of forest areas (Akulov, 2018);
- Creation of a unified registration system for bargains with forest lands (Akulov, 2018);
- Creation of the modern interactive map of forests (Akulov, 2018);
- Introduction of new rules for collecting reports, including the usage of software products, which help to control the lease holders' activities more efficiently and with high-quality, as well as the timeliness of their payments to the budget, the implementation of sanitary and recreational activities at the sites, recording the timber sales, as well as tracking the deforestation (The forestry automation is expanding in the Ryazan region, 2018;
- Use of GLONASS equipment to track the movement of wood (Irkutsk Oblast: GLONASS will look after the export of forest, 2017);
- Elimination of the human factor in the process of counting and dispatching wood (Drozhzha, 2018);
- "Forest Guard" system (IT Forest Guard, 2018).

Specific directions in the field of creating a single automated information system, as a single platform for providing information and analytical support for the activities of officials in the field of forest relations:

- Improvement of the existing federal systems (Federal State Information System "Information System for Remote Monitoring of the Federal Forestry Agency"; the unified automated state information system for recording wood and bargains with it) (Strategy, 2018);
- Creation of new systems: departmental fund of spatial data; automated system "Monitoring the credibility of forest pathology surveys"; Situational Center of the Federal Forestry Agency; unified automated information system) (Strategy, 2018).
- Creation of the modern optical-mechanical electronic systems production complex for multi-zone scanning devices for the latest Russian satellites like: Meteor, Meteor-MP, Okean, Obzor-O, Electro, and Arktica series. With their help, these satellites will be able to receive images of the Earth surface at once in several regimes of the spectrum, solving various tasks of climate and environmental monitoring - from hydrometeorological observations to monitoring the spread of fires, soil and water conditions, etc. (Emelyanov, 2018).

***2. Directions of digitalization in the interests of business (Voldaev, 2017)***

- Performance management, covering processes in the forestry, timber harvesting and wood processing industries;
- Design of "digital plants";
- Development of the project "digital harvest area";

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- The formation of the unified process management platforms, from the cultivation of planting material to the production of high-tech products;
- Automation of processes for specific areas and integration with digital technologies, supporting the processes of any specific industry;
- The creation of performance management centers, which are a single platform for management of processing and marketing.

***3. Directions of digitalization in the interests of the state and business***

- Decryption of aerial photography materials and shooting from space;
- Processing of forest inventory materials;
- Material and monetary valuation of the harvest areas;
- Ensuring the functioning of the geographic information system;
- Mapping (Voldaev, 2017);
- Systems for space monitoring of forest changes and forest accounting systems (Khabarovsk territory is switching to the forest automation, 2017);
- Keeping cadastral registration of the forest fund (Akulov, 2018);
- Organization of stock trading (Tretyakov, 2017);
- Blockchain technology (Tretyakov, 2017);
- Systems for operational accounting of the harvested wood movement (Akulov, 2018);
- Organization of satellite monitoring (Uralbumaga's experience in the implementation of the Smart Forest project is planned to be replicated throughout Perm Krai, 2018) and monitoring using unmanned aerial vehicles (Ministry of the Republic of Tatarstan, 2018);
- The introduction and use of innovative technologies in the financial market and in the timber trade (32. Tretyakov, 2017);
- Specialized digital platforms for the forestry.

As follows from the above-mentioned system of tasks for the forestry digitalization, the core and the main result after the creation of this system will be the construction of an information infrastructure.

Let's study the interpretation of the roadmap for the oil and gas industry to build the information infrastructure of the forestry, which effectiveness for society, as a supplier of wood products, is determined by the qualities of the following processes:

- Cartography and forest fund assessments;
- Measures for the conservation and improvement of the forest fund;
- Wood harvesting;
- Wood processing.

The studied roadmap consists of three major steps.

1. "Thing-digit", which includes the steps: mechanization, installation of sensors, data transfer.

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2. A “digit” contains the stages: the integration of technology and data, the analysis of large data arrays, visualization (an expanded presentation of information that facilitates the efficiency of its interpretation and use).
3. “Digit-thing”, which includes the stages: robotization (autonomous interaction with the real world), creation (using 3D printing for equipment production), virtualization (digital copying of tangible assets, processes and systems).

As follows from the forestry analysis, the Russian subsystems of the forest resources assessment and care could be in the second and third steps, but in this case, much depends on the development of space and aviation complexes, as well as the relevant monitoring equipment.

The approach to the digitization of the wood raw material processing is in many ways similar to the approaches that will be developed in other industrial sectors. However, it is worth noting that the cost and construction time of pulp and paper mills is significantly higher than in other countries (Strategy, 2018).

As for harvesting and wood transportation, the following technologies are in the basis of the Russian digital transformation model.

1. The mechanization of the harvesting process and timber transportation should consist in replacing the manual and whiplash harvesting and mainly using harvesters and forwarders;
2. Installation of sensors and remote control of operations:
    - The organization of aerospace monitoring will provide an objective assessment of the forest fund characteristics, which will greatly assist loggers both at the stage of obtaining lease rights to the forest fund and at the stages of planning and managing its operation;
    - Equipping the logging and transport equipment with sensors will enable the wood condition changes monitoring and assessing the state of the logging and transport equipment, which will reduce downtime and extend its service time.

What can we expect in the future from digital transformation? For what results can this activity be carried out? As a guideline, we give very rough estimates for answering these questions on the basis of the efficiency estimates obtained by Deloitte for the fuel and energy complex:

- Reducing the downtime of equipment by 20-30% as a result of proactive adjustments to the operation of the equipment in order to ensure compliance with changing operating conditions;
- 5-15% optimization of the production cost, due to monitoring and analysis of aggregated data.
- The annual cost reduction will be about 1% of the assets value and about 0.5% increase in cash flows of the assets value (excluding the reduction in costs associated with repairs and equipment failures).

The described above technologies will reduce transaction costs and capital costs. However, it should be noted that the decision to apply this or that technology, both at the level of tangible assets and at the level of digital assets, requires careful analysis and planning.

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## IV. DISCUSSION

It should be noted that the foreign trade turnover of Russian forest products is characterized by weak growth or stagnation (Akulov, 2018). Now, any negative trends in a particular area of the Russian economy are usually justified by the geopolitical difficulties observed in the past few years. However, since the 1990s, forestry has accumulated a number of serious problems impeding its development and transformation in accordance with the trends in the formation of the digital economy. Among them - the low level of material, technical, scientific and personnel support, an increase in forest resource losses from fires and pests (Voronin et al., 2018), lack of efficiency in forest management, the predatory activities of illegal loggers, etc. The lack of complete information on the state of forests also hampers the development of forestry enterprises. It is about the need to maintain a state register of forest areas, as well as cadastral registration of the forest fund. Cadastral registration is necessary in case of a land lease, permanent use, etc. In most regions, the necessary information is either not available at all or does not correspond to reality, which leads to negative consequences (for example, to large losses of tenants when implementing investment projects for the development of forest land). In some territories, a taxation describing the natural and age composition of forests, the quality and volume of wood was carried out in the last century, and maps of forest areas were compiled on the basis of expert assessments of the relevant authorities.

The problem of illegal deforestation and illegal turnover of industrial wood is highlighted. According to experts, their share in Russia is on average 20% of the total volume of harvest. According to the Ministry of Nature of Russia, for the last year, the volume of illegally harvested wood amounted to about 1.1 million $m^3$, and material damage - more than 10 billion rubles. (Official site of the Ministry of Natural Resources and Environment of the Russian Federation, 2018).

The presence of these problems leads to the fact that in Russia the main attention in introducing digital technologies is paid to monitoring the state and operation of the forest fund.

Today, the use of the following basic information systems can be noted in the Russian forestry.

1. Federal State Information System “Information System for Remote Monitoring of the Federal Agency for Forestry” (ISDM-Rosleskhoz) (FGIS, 2019).
2. The SFMS system (ScanEx Fire Monitoring Service) is a scan fire monitoring system developed by ScanEx) is a publicly accessible forest fire monitoring system (Sources of operational data on wildfires, 2018).
3. Satellite services (Savorsky et al., 2016).
4. The Unified State Automated Information System for Accounting of Wood and bargains with it (Strategy, 2018);
5. Orbital grouping of 89 satellites for socio-economic, scientific and dual use, including 9 satellites for remote probing, 2 of them for natural resources, 3 for hydrometeorological purpose and 4 for operational monitoring of man-made and natural emergencies (39A Roscosmos, 2018).
6. GLONASS equipment (Irkutsk Oblast: GLONASS will look after forest export, 2017).

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7. The system for organization of satellite monitoring "Parmagis" (The experience of the company "Uralbumaga" in the implementation of the project “Smart Forest” is planned to replicate throughout the Perm region, 2018).
8. The Forest Guard System (IT Forest Guard, 2018). Satellite monitoring systems can be used to collect, process, archive, and present remote monitoring data in order to obtain reliable full operational data on forest fires, monitoring compliance with forest legislation during logging and obtain other information about the state of the forest fund.

However, today in Russia, there is no center providing operational information on the state of the forest fund, and sufficient technological capabilities for conducting surveillance from space (Annotated list of the main sources of information on forest fires, GREENPEACE Forest Forum, 2011). At present, ISDM-Rosleskhoz, SFMS, FIRMS (Fire Information Resource Management System) are using images, obtained by the American MODIS systems (Barnes et al., 1998) on the Terra and Aqua satellites and LANDSAT ETM on the LANDSAT satellite. A European EFFIS (European Forest Fire Information System) is also used.

At present, various information services are functioning quite reliably, basing on which, the developed methods can be developed and implemented, including the Vega-Science satellite service, which is largely focused on solving problems associated with the study and monitoring of vegetation cover (Lupyan et al., 2014; Lupyan et al., 2015).

The use of the Unified State Automated Information System for Accounting of Wood and Bargains with it (EGAIS) began in 2015 in order to control the volume of wood transferred from one subject to another (EGAIS accounting for wood and bargains with it, 2019). From January 23, 2019, the provision of information from ForestEGAIS for effective control over the origin of wood in the Russian Federation has become automated for related control agencies (UNITED STATE AUTOMATED INFORMATION SYSTEM FOR WOOD AND BARGAINS WITH IT, 2019).

It is planned that by 2025 the grouping of Russian remote probing satellites will increase up to 25 (the grouping of remote probing satellites will increase by 2025 up to 25, 2019). In addition, a group of BRIGS remote probing satellites will be created (BRICS will create a group of Earth remote probing satellites, 2018).

GLONASS equipment can be used to track the movement of wood, as well as to control the level of fuel in tanks and high-speed mode, and in the future, it will be possible to transfer other values of engineering parameters. The Ministry of Natural Resources and Environment of Russia proposed to equip the wood transporters with GLONASS equipment (GLONASS for tightening control over wood turnover, 2018).

In Permsky Krai, in May 2018, Uralbumaga, a member of the PTsBK Group of Companies, launched the implementation of the Smart Monitoring program for satellites, based on the ParmaGIS software, developed together with scientists. The result of this work will be an information array, which will facilitate production and financial control, provide spatial analysis, including control over the sanitary condition of the forest resource, identifying the sources of fire, as well as facilitate reporting with confirming satellite images.

The main tasks of the Forest Guard system are to locate illegal logging sites and transfer information about them to the executive authorities of the constituent entities of the Russian Federation and law enforcement agencies.

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In the coming years we should expect the development of these systems in the process of digital transformation.

Let us consider Russia's position in the world in terms of digitalization issues. Table 1 presents data on the volume of the economy and the characteristics of scientific research of the countries that are recognized as leaders of digital technologies.

Table 1: Data on the Volume of the Economy and the Characteristics of Scientific Research for the Countries Recognized as Leaders of Digital Technologies

| No. | Country | GDP (at par) | | GDP (at purchasing-power-parity) | | Science costs (at purchasing-power-parity) | | Scientists number |
|---|---|---|---|---|---|---|---|---|
| | | IMF list | WB list | IMF list | WB list | | | |
| | | billion US dollars | billion US dollars | billion US dollars | billion US dollars | billion US dollars | % from GDP | thousand people |
| 1 | USA | 18624 | 18624 | 18707 | 18624 | 511,1 | 2,74 | 1380 |
| 2 | China | 11222 | 11191 | 21314 | 21412 | 451,2 | 2,12 | 1692 |
| 3 | Japan | 4949 | 4949 | 5250 | 5369 | 168,6 | 3,14 | 665,6 |
| 4 | Germany | 3479 | 3478 | 4022 | 4030 | 118,5 | 2,94 | 400,8 |
| 5 | South Korea | 1411 | 1538 | 1938 | 1877 | 79,4 | 4,24 | 361,3 |
| 6 | United Kingdom | 2661 | 2651 | 2824 | 2798 | 47,2 | 1,69 | 291,4 |
| 7 | Russia | 1285 | 1285 | 3881 | 3640 | 39,9 | 1,10 | 428,9 |
| 8 | Sweden | 496 | 571 | 498 | 485 | 15,8 | 3,25 | 70,4 |

Source: compiled by the authors, based on the data from: Ratay, 2018; IMF, 2018; The World Bank, 2018; Gross domestic product based on purchasing-power-parity (PPP) valuation of country GDP. IMF, 2018; Gross domestic product based on purchasing-power-parity (PPP) valuation of country GDP. The World Bank, 2018.

Analysis of table 1 shows that great results in digitization can be achieved without having a very large amount of GDP, as we see in the examples of Sweden and Singapore. We also see that the starting positions of Russia both in terms of the volume of the economy and in the number of scientists in the country allow us to set the tasks of digital transformation. As noted above, the size of investments in digitalization, which Russia intends to make, is not at all small (more than 4 billion US dollars per year). There is only one essential thing – the effectiveness of the investments.

## V. Conclusions

In this study we tried to describe the problems of the Russian forestry. The strategy of the Government of the Russian Federation to overcome these problems in the aspect of the country's economy digitalization was analyzed, as well as proposals related to digitalization in the interests of the forest business. The efforts of other countries in the field of digitalization were studied.

In terms of the economic opportunities (if we evaluate GDP by purchasing-power-parity) and scientific traditions (there are a relatively large number of researchers in the country), Russia is able to achieve significant results in digital transformation. The spending plans on digitalization confirm the country's intentions to follow this path. The amount of planned digitalization costs is quite significant.

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However, the role of digitalization can be presented quite clearly in matters of mapping, cadastral registration, assessment of forest areas, woodworking, but the question remains, how the general digitalization of the country will help businesses, such as wood harvesting, where, despite automation, the role of man takes the main place. In this case, digitalization simplifies the work of the forest machine operator and apparently, we should not expect a complete replacement of the person in the foreseeable future.

We found that the main centralized efforts in the field of transformation of the forestry are aimed at strengthening control over the conservation, development and operation of the forest fund.

The low representation of the tasks of developing digital technologies for business can be explained by the fact, that the real prospects for the development of monitoring systems (including space and aviation) exist in the implementation of the Strategy for the development of the forestry and the risk of slowing down the introduction of modern technologies in logging and wood processing is quite high. This is explained by the fact that many modern forest technologies are imported into Russia and there is not enough tradition and experience in the country to produce them. In addition, as shown by the analysis made in the Strategy for the Development of the Forestry, the cost and timing for the construction of a pulp and paper mill in Russia is significantly higher than in other countries.

The problem of the digitalization development of the forest business is in many ways common to the industrial sectors of Russia, which is confirmed both by the analysis of forest industry technologies and technologies of the country's leading oil and gas industry.

Thus, overcoming threats that reduce the effectiveness of Russian industries, including the timber industry, can and should be realized with the help of digital technologies. However, there are risks associated with slow import substitution and the readiness level of industry experts.

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