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ACADEMIC SCIENCE AND NEW INDUSTRIALIZATION (EXAMPLE OF THE KOMI REPUBLIC) [1]

Today, the new guidelines of strategic planning for the development of Russia and its regions are increasingly determined by science and technological progress. The results of scientific research, which deserve attention in terms of improving the scientific, technical, and socioeconomic processes in the Northern and Arctic territorial and economic systems (in our case, the Komi Republic), are usually presented in the form of interdisciplinary projects that generate the results of studies on socioeconomic, humanitarian, and medical and biological problems as well as on the issues of preserving the biosphere and ecosystems with simultaneous development of bioresource economy, rational use of mineral and energy resources, spatial development, and creation and use of innovative technologies. The key idea of this article is implementing the new industrialization in the Komi Republic by taking into account the results of research conducted at the institutes of Komi Scientific Centre of the Ural Branch of the Russian Academy of Sciences. The applied research of the institutes of Komi Scientific Centre is based on fundamental studies and closely connected with the practice of development and distribution of productive forces. It is focused on implementing the new paradigm of Northern policy aimed at not only the development of mineral and energy resources for external consumers but also at improvement, sustainable development, and creation of appropriate conditions for the people who put their roots in the North. Particular attention is drawn to the reproduction of human and natural resource potentials. The sectoral structure of the economy of the republic, and most other Northern and Arctic regions, will not change dramatically in the future, but the inner content of productive forces will be different in line with the concept of resource-based innovative development.

Keywords: Komi Republic; Komi Scientific Centre of the Ural Branch of the Russian Academy of Sciences; regional development; relationship between science and practice; science and advanced industrial and social technologies; new industrialization

Introduction

Currently, the forecasts for the development of specific regions are elaborated under Federal Law No. 172-FZ of June 28, 2014, On Strategic Planning in the Russian Federation, methodological guidelines of the Ministry of Economic Development of the Russian Federation, and top-down macroeconomic parameters of future socioeconomic development in Russia. As a result, each state document of forecasting nature prepared at the subfederal level has a somewhat predetermined structure of its text and numerical supplements.

Usually, the forecasts of regional development for Northern and Arctic regions reflect the difficulties in ensuring the growth of their economy amid the sharp fluctuations in the global prices for hydrocarbons and minerals as well as the lack of capacity in the Russian processing industry. For the upcoming 10–15 years, the GRP dynamics stays in the range of 2 %–3 % a year. At the same time, there is a clear lag in organizing new technologies, and the need to improve the labor productivity becomes the key problem.

Decree of the Russian President No. 596 of May 7, 2012, On the Long—Term State Economic Policy provides for 1.5 times increase in labor productivity across the national economy in 2018 compared to 2011. The economic situation in Russia is such that this target will not be achieved in most of the regions. In the Komi Republic, the growth of labor productivity for all types of economic activities will not exceed 10 % in 2018 (compared to 2011). This can be explained by the two main reasons: lack of order in the use of labor resources and low level of production technology.

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This article is based on the report presented by the author on June 14, 2016, at the meeting of Scientific Advisory Council under the Head of the Komi Republic and the results of scientific research conducted by the institutes of the Komi Scientific Center, the Ural Branch of the Russian Academy of Sciences, as well as the materials of the Socioeconomic Development Strategy of the Komi Republic until 2030.

The example of "The Strategy of Socioeconomic Development of the Komi Republic for the Period until 2030" shows that the current forecasting structure leaves no place for science and scientific and technical progress. It does not reflect the problems of transition from lower to the higher techno-economic paradigm. Nor does it reflect the problems of improving social relations. Somehow, it manages to avoid the issues of optimal land use that would take into account the need to organize an environmentally clean agriculture, maximize the size of distributed land reserves, and its structuring by types of ownership, including federal, regional, municipal, and private. The same applies to forest plans and subsoil use programs. As for the progress in managing the household farms and other types of small farms, it has not been considered so far in any state document.

This article does not deal with the growth of everything and anything but presents the most relevant issues for ensuring the qualitative transformation of existing and creating new industries and spheres in the economy of the Komi Republic based on implementing the results of scientific research. The author proceeds from the fact that the scientific institutes of Komi Scientific Center of the Ural Branch of the Russian Academy of Sciences base their ongoing research on combining the dominant areas of fundamental science and applied disciplines along with their projections on the development and distribution of productive forces of the North and Arctic Russia. An emerging and relatively new task is to generate scientific advances to transfer them to the technological sphere. This applies to the development of methodologies for assessing the mineral resource and bioresource potentials, providing scientific substantiation for the use of geo- and biotechnology, production of advanced materials (including by using the advances in nanomineralogy), chemicals and pharmaceuticals, bioactive substances. Social sciences and humanities are more focused on studying the dynamics in the development of public institutions and natural and economic systems based on Northern and Arctic natural environment and ethnic culture of peoples who put their roots in the North.

Today, it is extremely relevant to mobilize the overall scientific capacity of the Center to determine the strategy for rational use of mineral resources and coal reserves of the Timan—Ural region, hydrocarbons of Timan—Pechora province, bioresources of Bolshezemelskaya tundra and Dvina—Pechora taiga and to establish a versatile springboard for industrial and transport development of Arctic areas, while preserving and developing the North European societies and their ethnic cultures.

Two Sides of Regional Governance

The scientific research proceeds from the fact that in its regional development each region focuses both on the national and global economy and on its own needs in the comprehensive development. In practice, this means dividing the activities of regional governments into two parts: 1) Working with the federal government within the framework of intergovernmental relations and target-oriented programs, collaboration with national and multinational companies to ensure the placement of large industrial and transport facilities in their territories and to level the public welfare protection; 2) Exercising their authority with regard to the comprehensive development of the region, which requires sufficient budgetary resources. The dichotomy of this kind also applies to academic centers. On the one hand, they conduct research in accordance with the logic of science proper and focus on its latest achievements at the national and global levels. On the other hand, they conduct research by taking into account the strategic forecasts for the development of specific industries and areas.

For the Komi Republic, the first direction (let's call it "federal") can be represented historically (by selecting the most important) as follows: 1920–1930: Building the "currency-generating workshop of the country" by exporting lumber abroad through Arkhangelsk port and selling it for gold, mining heavy oil in Yarega, and organizing the production of cold-resistant oils in Ukhta refinery, which played a significant role for the use of tanks during the World War 2; 1940–1950: Building Kotlas—Vorkuta railway, developing Pechora coal basin, supplying coal to besieged Leningrad and for the Northern Sea Route, participating in the creation of the Northern coal and metallurgical industrial base; 1960–1970: Building Syktyvkar forest industry complex for production of pulp and paper, the largest in the Soviet Union, developing Vuktylskoye gas condensate field and Northern Lights gas pipeline; 1970–1980: Developing Usinsk group of oil fields and building Pechora GRES power plant; 1990–2010: Developing Srednetimansky bauxite mine areas and integrating them into technological cycle of aluminum production in the Urals; complete reconstruction of Ukhta refinery, significant modernization of mining industry in Vorkuta and Syktyvkar.

There was a systematic study and development of natural resources. The mineral and raw material potential of Pechora—Ural region holds one of the leading places in the Russian economy as well as the potential of the forest resources (2.8 billion m^3). These boreal coniferous forests are especially valuable for industrial use. Water resources are also becoming increasingly important. In the system of geographical division of economic functions, the Komi Republic has a strong ecological specialization. An example of this is the creation of Pechora—Ilych State Biosphere Reserve in 1930 and Yugyd Va Natural National Park in 1994. The Komi Republic has 239 registered specially protected natural sites, with the total area of 5.4 million ha.

All this was achieved with the direct participation of the Komi Scientific Center, the Ural Branch of the Russian Academy of Sciences. We should especially note the contribution of its researchers to the study of Pechora coal basin, Timan—Pechora oil and gas province, Timan—Ural mining region, issues of integrated development of land (soil) and forest resources and protection of the environment [3].

At the present stage, the participation of the Komi Republic in the economic development of Russia can be strengthened by implementing a number of projects in the area of new industrialization. These should include, first of all, the projects aimed at building the mining, chemical, and metallurgical complex based on the use of bauxite, titanium, manganese, and other ores and rock salt. It would be advisable to discuss with the federal government the issue of establishing, within the Komi Republic, a gas and chemical complex involving the use of transit of gas and manufacturing of polyethylene products. The project of Troitsko-Pechorskaya Pulp and projects for the development of wood processing and manufacturing of wood products deserve particular attention. The Komi Republic is also connected to the national economy by two mega projects in the area of transportation, including the construction of main gas pipeline system along the route Bovanenkovo—Ukhta—Torzhok and Belkomur railway (Arkhangelsk—Syktyvkar—Solikamsk—Perm).

For a long time, the second (regional) direction of socioeconomic development was following the first. Large industrial construction projects were accompanied by the development of new infrastructure, though usually on a residual basis (let's remember such an exceptionally important historical fact as the creation of cities of Vuktyl and Usinsk, construction of Ezhva, an urban district in Syktyvkar, and in fact a new town). At the same time, technical condition of the road network and other infrastructure sites was always considered by the experts as unsatisfactory. A tremendous shortcoming in the economy of the Komi Republic is shallowing of its rivers and worsening of transport accessibility in many population centers.

If we consider the above directions together, then it is necessary to highlight the need for the leaders of the Komi Republic to focus on working with the industrial companies (corporations) to strengthen their role in comprehensive territorial development. Along with the technical design of new construction projects, it is desirable to plan the social development of relevant areas, which should be regarded as a regulatory requirement.

Both major systemic projects of the national economy and relatively small projects, the importance of which is limited to the framework of the regional economy, should be implemented by using the advanced technology based on fundamental knowledge.

Urgent Tasks for the Development of the Komi Republic To Be Addressed Jointly by Science and Practice. Rules of Collaboration

The urgent tasks include the following:

— Protecting public health and improving human potential.

— Preserving bioresource diversity conservation and reproduction of tundra and taiga geobiocenosis.

— Increasing the geological potential of the area and developing physical and chemical methods for extraction and processing of minerals.

— Production and use of polymeric and composite materials.

— Production of chemical and medicinal preparations, bioactive substances.

— Creating new technologies for the comprehensive use of raw materials and waste products.

— Optimizing energy sources and ensuring energy reliability.

— Improving economic and socioecological mechanisms of environmental management, including traditional (Northern) one.

— Developing social systems and institutions in view of the Northern and Arctic natural environment and its ethnic and cultural diversity.

— Using the theory and methodology for reproduction of natural-economic complexes based on geosystem approach to territorial development practice.

— Generating scientific advances to transfer them to the technological sphere.

A regional research center cannot function without communicating with the government and business organizations. But in this interaction, it is very important to maintain a civic position, provide objective assessments of scientific, technological, social, and economic processes in the country and the region, and realize the degree of personal responsibility in defining the strategies for the development of their own region. At the same time, it is necessary to adhere to certain rules of interaction between theory and practice. The author believes that the experience gained by the institutes of the Russian Academy of Sciences has clearly demonstrated the futility of abstract recommendations (given without a clear target and usually delivered in a preaching manner), and on the contrary, it has shown significant benefits of joint work conducted by the theorists and practitioners under specific programs and projects aimed at creating something new or modernizing what is already existing.

However, in a rationally organized collaboration, the scientists often face a trap of false practicality. To avoid this, it is advisable to follow the rule that science turns to practice on the basis of theory, and practice turns to science on the basis of experience. Both areas have their own methodology of work. Therefore, it is very important to understand the danger of the situation when science begins to play on foreign turf. But there is also another false success when a researcher, while playing on its own turf, uses the concepts derived from earlier theoretical schemes and models. The researcher hybridizes one theory with another and gets a third one, the reliability of which is often not backed up by the practice. When science for a long time assumes the role of such theorizing, this leads to its excessive formalization. A scientist explains what should happen and how but does not know what actually happens and how. Of course, science is not obliged to provide practice with some standard directions, but it should reveal the essence of what is happening, its sources and driving forces. An important role is played by the methodology of translating theoretical knowledge into practice. A version of such methodology is presented in Table 1.

Table 1

The methodology of translating theoretical knowledge into practice

Stages of new knowledge acquisition	Methodology of new knowledge acquisition		
Theory	Building an ideal image of the studied object	Systematizing properties and qualities of the object	Structuring the object
Applied research	Transforming scientific knowledge for practical use	Updating development problems	Highlighting key development factors (attractor structures)
Practice	Preferences in scientific and technical progress, development and distribution of productive forces	Strategic planning	Formulating assignments for administrative organizational structures

The reliable basis for proper understanding of the mission of the Academy of Sciences institutes lies not in the integration but in the separation of functions and creative communication between the scientific institutions, state authorities, and business entities.

Socioeconomic, Humanitarian, and Medical and Biological Problems in the Vital Activities of Population of the Komi Republic

Recently, the Komi Republic has made a significant progress in the area of demography (by improving the quantitative and qualitative characteristics of fertility, reducing mortality and increasing life expectancy, lowering infant mortality, and ensuring positive natural population growth), which is largely the result of ongoing state demographic policy. At the same time, there is a continued and steady migration loss, while in the area of natural population movement there is a high likelihood that the trends may reverse from positive to negative [8, 9]. To this, we can add almost complete disappearance of the stimulating role previously played by higher earnings in the North, low level of social infrastructure development, loss of traditional socioeconomic ties between towns and countryside; fear of losing health.

Given the above, A. V. Smirnov (Institute of Socioeconomic and Energy Problems of the North, Komi Scientific Center of the Ural Branch of the Russian Academy of Sciences) used mathematical modeling to forecast the population of the Komi Republic and its regions (Table 2).

Table 2

Forecast of population of the Komi Republic in cities and districts for the period until 2030, people [11, p. 153]

Cities and districts	Total population, people					Increase/decrease 2030 to 2010, %
	2010	2015	2020	2025	2030	
The Komi Republic	901,004	854,150	808,280	762,987	719,002	–20.2
Syktyvkar	250,718	257,745	261,633	262,675	261,272	4.2
Vorkuta	95,848	79,046	65,433	54,103	44,480	–53.6
Vuktyl	14,872	12,684	10,662	8,978	7,557	–49.2
Inta	35,179	29,923	25,479	21,784	18,610	–47.1
Pechora	57,356	53,032	49,231	45,264	41,380	–27.9
Sosnogorsk	46,773	44,433	41,928	39,321	36,834	–21.2
Usinsk	47,228	44,784	42,437	39,840	37,391	–20.8
Ukhta	121,695	118,699	115,422	111,478	106,707	–12.3
districts						
Izhemsky	18,771	17,079	15,459	13,908	12,603	–32.9
Knyazhpogostsky	23,432	20,416	17,493	14,929	13,013	–44.5
Koygorodsky	8,431	7,817	7,240	6,648	6,134	–27.2
Kortkerossky	19,658	19,114	18,188	17,312	16,439	–16.4
Priluzsky	20,737	18,324	16,188	14,301	12,673	–38.9
Syktyvdinsky	22,659	23,929	24,688	24,672	24,490	8.1
Sysolsky	13,956	13,293	12,323	11,420	10,563	–24.3
Troitsko-Pechorsky	13,925	11,891	10,279	8,856	7,726	–44.5
Udorsky	20,398	18,397	16,583	15,074	13,547	–33.6
Ust-Vymsky	29,474	26,896	24,178	21,869	19,746	–33.0
Ust-Kulomsky	26,858	24,910	22,844	20,954	19,246	–28.3
Ust-Tsilemsky	13,036	11,738	10,592	9,601	8,591	–34.1

At first, the dynamics of the population seems to be very unfavorable. But we must bear in mind that it corresponds to the desires shared by a certain part of population to live in more comfortable climatic conditions and to have a job that corresponds to their qualifications. Therefore, in migration policy, it would be desirable to follow the rule of "encouragement instead of constraint" [12]. We recognize the fact that the Komi Republic has few jobs with the labor organized at a high technological level. There is no system interface between the "main" production operations and subsequent support and service operations. When it comes to modernization and growth of labor productivity, it would be appropriate to view the economic indicators within territorial and economic systems so that all their elements are improved simultaneously.

We would like to pay particular attention to the interest of businesses to mobile labor teams that have no social obligations to the region and act in accordance with the principle "I came, I earned, and I left." Their number is growing. On the one hand, this reflects the new possibilities for developing the natural resources in the North and the Arctic, and on the other hand, it creates the grounds for social conflicts with the local population, which is left without work but does not wish to go to other regions. Such a mobility is economically effective but socially unjust. According to the Russian Federal Migration Service, in 2015, the number of rotation shift workers in the Komi Republic was 25 thousand or about 6 % of the annual average number of those employed in its economy; 34 % of those working in rotation shifts are employed in mining; 23 %, in construction; and 22 %, in transport and communications. Many teams of loggers arrive from other regions and never register as a labor resource in the Komi Republic.

The essence of human resource problem also lies in the disparities between the number of employees with secondary and higher education and failure of vocational training in general to meet

modern requirements determined by scientific and technological progress. This includes the shortage of highly skilled workers and technicians and the excess of specialists with higher education, especially in the area of economics, law, and many humanities; mismatch between the specialties of graduates and specialization of economies in the cities and districts; excess of engineering positions filled by technicians and workers; noncore use of real engineers; predominance of positions involving routine activities over those that require high level of creativity and organization. These shortcomings make it difficult to optimize the labor market and create new businesses, especially large ones.

In the past 25 years, the Komi Republic has experienced the overall deterioration of utilities, including heat, sewer, and water networks, with the level of wear exceeding 60 % and continuing to deteriorate; the same can be said about the housing stock where more than 9 thousand houses have the wear ranging from 30 % to 65 %, and 1.5 thousand houses, more than 70 %. It is necessary to rebuild the facilities of public utilities infrastructure and introduce energy-saving technologies in the utilities sector.

The utilities sector is directly related to vital activities of households, which in the current conditions are based on centralized supplies of water, electricity, heat, gas, and gasoline, if we also take into account private cars. However, three factors cause a gradual shift away from centralization. These include increasing technical capabilities for autonomous supplies of household with heat and hot water; the excessively high rate of increases in the tariffs for services of utilities sector; and remoteness of many rural settlements from centralized sources of water, heat, and gas. Today, already the use of home-based heat generating units becomes cheaper than paying for the centralized supply of hot water. The opposite trends of centralization and decentralization in the energy supply for households affect the foundations of not only fuel and energy complex but also the entire economy.

The science is working on solving the problem of building the usage structure for end-point types of energy in the Russian socioeconomic conditions by taking into account the climatic diversity of its regions. The main difficulty in addressing this problem is the obvious mismatch between the high cost of electricity and fuel provided to households and relatively low incomes of most Russian citizens. In subsequent years, this gap has increased, and now it represents a real threat to the economic security of the population. An important aspect of socioeconomic forecasting is to involve rural households and countryside farmsteads in the technical progress. They need to be provided with small-scale mechanization means. In addition, it would be advisable to organize technical public usage stations in the rural settlements (to rent machinery and equipment).

Table 3

Distribution of integrated development potential in the population centers of the Komi Republic [4]

Type of population center in terms of its integrated development potential	Number of population centers	Residents, thousand people	Share of population center type, %
Large population centers with high potential for production and social services	36	741.4	82.2
Medium population centers with average potential for production and social services	99	63.9	7.1
Medium population centers with below-the-average potential for production and social services	121	52.7	5.9
Medium population centers with below-the-average potential for social services	52	17.7	2.0
Medium and small population centers with low potential for social services	114	15.3	1.7
Small population centers with low potential for production and social services	41	2.3	0.3
Small population centers without production and social services connected to external energy supply and communication sources	242	7.4	0.8
Total	705	900.7	100.0

The scientific approach to forecasting the regional development implies a detailed examination of population settlement forms. The types of population centers indicated in Table 3 describe a spatial aspect of the socioeconomic system in the Komi Republic and indicate the need to develop cooperation ties between the centers and their surrounding areas on the basis of clusters and other forms of networking.

The above living conditions of people in the Komi Republic, which are unfavorable in many respects, affect the public health. The incidence of such deceases as tuberculosis, cancer pathology, respiratory and circulatory diseases is significantly higher among the northerners than on average in Russia. The development of physiological and biochemical foundations for adapting the humans to difficult and extreme living environment and identification of biological impact produced by individual components of the climatic system on the functional systems of human body become especially important in defining the future socioeconomic condition of the Komi Republic.

Biosphere, Ecosystems, and Bioresource Economy

The Komi Republic has land resources with very different quality of soils. The research identified natural and effective (calculated) productivity of the most widespread soils; this allowed compiling a soil map of the Komi Republic (at the scale 1: 1000000) that served as the basis for preparing a series of assessment and forecasting environmental maps, which provides the foundation for rational land use[2].

The Komi Republic has sufficient solar radiation, moisture, and heat to obtain the potato yields of 300–400 metric centners per ha, perennial grass hay yields of 80–100 metric centners per ha, and rye yields of 20 metric centners per ha (with a balanced fertilization, introduction of micronutrients, and liming). The science points out that it is possible to fully meet the needs of the Komi Republic's population by locally produced potatoes and open ground vegetables, expand the production of greenhouse vegetables, increase the share of locally produced meat and meat products to 35 %–40 %; milk and milk products, to 40 %–45 %; eggs, to 75 %–80 %; ensure sustainable development of traditional activities (reindeer husbandry, fishing, gathering and processing wild plants) by fully using the gene pool of plants that are traditional for northern territories (such as winter rye), introducing new species and varieties of crops and animal species, and adapting them to northern environment.

To realize these opportunities, Komi Scientific Center is conducting the in-depth studies aimed at creating geographic information systems (GIS) to assess the status and dynamics of soils and grounds, including multiyear-frozen soils, during the climatic instability; implementing a unified state system of environmental monitoring; valuating the human impacts, and providing environmental assessment of ecosystems. Such problems become particularly relevant for the Arctic zone. The plant communities of reindeer pastures experience the decline of lichen forage stocks, an increase of shrubs abundance, and acceleration of bogging processes. There is an increasing level of pollutants, including heavy metals, in the forage, soil, and water. The scientific substantiation of a comprehensive solution for the provision of reindeer farms with forage resources becomes more and more relevant. This involves fundamental research of tundra as a unique natural ecosystem [6.10].

The forecasts of socioeconomic development of the Komi Republic should pay special attention to aquatic bioresources and providing the population with fish products. In 2004–2014, the Komi Republic increased its salable fish production by more than 60 times to 3,500 metric centners (mainly trout and carp). This included the establishment of 6 fish farms using mainly man-made reservoirs and cage culture fishery. At the same time, the research conducted to find the bodies of water suitable for commercial fish farming in the Komi Republic identified only a limited number of such bodies of water. It is quite evident that the development of fish farming and the increase in fish farming should be focused on creating high-tech fish farms.

Forest landscapes are predominant in the Komi Republic. Its territory accumulates raw wood resources that are large enough for developing the forestry and wood processing industry. Along with marketable timber, the region has considerable additional wood resources (stumps and roots, branches and twigs, bark, wood greens), the total reserves of which in ripe and overripe plantations of exploitable stock reach more than a billion tons. These resources are a significant reserve for the wood chemical industry and wood board production. They can be widely used for making certain agricultural products as well as in medical and perfume industries.

[2] These and many other maps on the nature, population, and economy are included in the Atlas of the Komi Republic [1], which in many respects is a guide for action and, therefore, is considered as a key scientific result of great practical value.

In the forests of the Komi Republic, the usable stock of mushrooms is estimated to average 82 thousand tons, wild berries, to 151 thousand tons annually. The forests have huge reserves of medicinal plants. The region's forests perform an important biosphere, climate-regulating, and environment-regulating function. In this regard, the development of regional comprehensive programs of forest resource use should proceed from a conceptual base formed by the principles of long-term, continuous, and sustainable forest management that would preserve the environmental role played by the forests [2, 5].

It should be noted that in the Komi Republic science allowed creating the foundation for maintaining the environmental balance. The surface area of certified forest management reached 3 million ha or half of the area occupied by exploitable forests. However, in recent years, the biologists have been paying particular attention to the two problems: the impact of logging on the quality of forests and impact of climate on the productivity of forest communities.

As a result of large concentrated logging, the highly productive pine and spruce forests are gradually replaced by predominantly hardwood saplings. In most cases, they are characterized by low productivity, lower wood quality, reduced resistance to adverse factors such as bogging, deteriorating physicochemical properties of soil, frost, etc. The transformation of forests is accompanied by the transformation of animal and plant life, water, and thermal characteristics of the northern river basins.

With ongoing research into the effects produced by climate warming on the productivity of the northern forests, this question still remains open. Some experts believe that the warming will increase the productivity of forests. However, in the recent years, an increasing number of experimental data has emerged pointing to a mixed reaction of woody plants to temperature changes, largely depending on the tree species and forest site. In addition, the warming could lead to the accelerated spread of diseases and forest pests. This will deteriorate the quality of the wood, intensify the destruction of plantations as a result of increasing attrition, which ultimately can lower the resistance of forests to fires, changes in the composition, and structure of timber stands.

The dramatic change in geographic, socioeconomic, and bioresource characteristics of forest stock in the recent years revealed the urgent need to prepare a new forestry plan.

One of the main causes for the current critical situation in the forest industry complex is its focus solely on processing most of the wood, including bold timber, for the production of pulp and paper, logging and export of raw materials outside the Komi Republic. Therefore, one of the conditions for improving the use of forestry resources is the investments in the creation of local production facilities for wood machining and deep chemical processing of small merchantable wood, forest residues, and nonwood raw materials in the areas of intensive logging with access to the markets of Russia, CIS, and other foreign countries.

The scientists of Komi Scientific Center believe that it would be very promising to ensure bioconservation of pulp raw material to produce valuable biological preparations and technically important products. For example, the cultivation of wood fungi on pulp waste (sawdust, chips, bark) allows obtaining the feed additives for livestock production; the production of glucose by enzymatic hydrolysis of pulp is also very profitable economically and advisable from the environmental point of view. In biotechnology, the use of cell cultures as producers allows deploying a wide range of production facilities for biopolymers and low-molecular bioregulators. Dendrochemistry also claims the ability to recycle the entire wood biomass, including the production of alcohol, turpentine, provitamin concentrate, conifer and essential oils, balsam paste, coniferous wax, polyprenols, etc. The prospects for the development of rural energy industry are associated with the use of wood waste[3].

Mineral Resources and Fuel and Energy Complexes

The mineral resources found and explored in the Russian North and the Arctic form the foundation of Russia's mineral, fuel, and energy base [13]. The experience of the Komi Republic shows that scientific and technical progress in these complexes is associated with the latest developments in the area of nanotechnology and electronic engineering, materials science, organic and inorganic chemistry, equipment and technology customized for Northern (Arctic) use, safety, information science, physiology, medicine, and other scientific branches.

[3] V. N. Lazhentsev. (2016). Geosistemnyy podkhod k problemam sotsialn-ekonomicheskogo razvitiya regionov Severa Rossii [Geosystemic approach to the problems of socioeconomic development in the regions of Russian North]. Ekonomicheskie i sotsialnyye peremeny: fakty, tendentsii, prognoz [Economic and social changes: Facts, trends, forecast], 1(43), 81–95.

The expansion of the mineral resource base for mining production is largely dependent on development and introduction of new technologies that allow for effective and long-term work in the fields already under development and in the areas with refractory, "persistent" ores. This is where it is possible to make the efficient industrial scale implementation of many advanced geotechnologies, such as underground hydraulic mining, underground and heap leaching, methods for biotechnological processing of mineral resources, many modern methods of ore preparation, ore preconcentration, concentration and separation of minerals.

Particular attention should be paid to production technology, transportation, and processing of oil and gas. For example, the oil reservoir recovery currently fell to 30 %, while 70 % is left in the soil (in the US, this figure is 51 % and 49 %, respectively) [7]. It is necessary to skillfully combine vertical and horizontal drilling, create underground gas storage facilities, take into account the danger of ultra-high reservoir pressure, and adopt new technologies of oil refining. The hasty departure to new mining sites often leads to enormous losses; to reduce their level, it is desirable not only to implement new technological methods but also to adopt a statesmanship approach to licensing of economic activities on old and new mineral deposits.

The development of the mining complex is directly related to the production of composites and building structures by using fiber reinforced plastic and cementitious materials based on magnesia dolomite mixes, sulfur, Portland cement. The composite materials with high mechanical and chemical properties can be useful in the construction, pulp and paper industry, oil and gas companies.

Conclusion

The example of the Komi Republic shows the possibility and expediency of resource-based innovation strategy. In addition, the raw materials sector can deliver new products that will be competitive on global markets. Along with the products manufactured by the defense industry, the latest technology for extraction and processing of raw materials may become a prestigious Russian product.

The scientific substantiation of conditions and stages for the development of productive forces in the Russian North allows assessing more correctly the real human, scientific, and technical potential of its regions. Today's socioeconomic agenda is shifting from "in-breadth" development of the North to its "in-depth" development—that is, to updating already existing economic systems. This thesis is confirmed not only by economic calculations but also by the very structure of research projects and publications prepared by the institutes of Komi Scientific Center of the Ural Branch of the Russian Academy of Sciences, where the focus is on the restructuring of the production systems, population settling, and transportation.

The results demonstrate that the technological progress and subsequent modernization of existing production facilities, infrastructure improvement of developed areas, increase in the living standards and quality of life of people, who put their roots in the North, with account of traditional forms of economic activities of indigenous minorities, are the priorities in the development of productive forces in Northern regions. The progression from developed territories to new territories and water areas is associated with tremendous costs and requires time for scientific and technical preparation. In this case, the very system of R&D plays a pioneering role in the development and improvement of territories and itself becomes a new industry.

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