

## Innovation Course of Economic Development in the Northern and Arctic Territories in Russia and in the Nordic Countries



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**Abstract.** The policy of Russia in the Arctic is based on innovation modernization in the interests of national security, development of the smart use of natural resources, conservation of unique arctic ecosystems and local communities. The aim of the present research was to analyze specific features of innovation policy in Northern and Arctic territories of Russia and the Nordic countries. The article presents an original analysis of development of such a policy, which, in our opinion, can be carried out with the help of considering development scenarios of the Arctic zone and challenges of their implementation in the long term, with the help of studying the situation in the Northern territories and countries in national and global innovation activity rankings; with the help of studying approaches to the formation of innovation policy in the Nordic countries, the experience of which could be used by Russian Federation constituent entities that have similar geographical and geopolitical features. We considered two strategic scenarios of socio-economic development of the Russian Arctic zone and the innovative scenario deserves priority attention. Despite the government's efforts to diversify the Russian economy, it still remains resource-driven. So far, innovation developments in the primary industries supported by the ideology of import substitution has not changed the situation for the better. The present article highlighted the challenges that hinder the implementation of innovation trends in the Russian Arctic economy. However, the Arctic zone of the Russian Federation (the Russian Arctic) provides examples of successful implementation of innovation (in the Republic of Sakha (Yakutia), in Yamalo-Nenets Autonomous Okrug), as evidenced by national rankings. Russia's neighbors in the Arctic region such as Denmark, Iceland, Sweden, Norway and Finland, all of which entered a post-industrial phase of development over 30 years ago, are current leaders in global innovation rankings. It is of practical interest to study characteristic features of development and innovation in the Nordic countries, their experience and possibilities of its use under the Russian conditions. In conclusion, we note that the development and implementation of innovation technology, the use of foreign experience, international cooperation tools and perspective areas of intellectual service in the Arctic economy can serve as a response to system and rapid transformations that occur in the Arctic region at present. The material of the article can be used in the educational process in universities, it is also relevant for government officials, researchers, geographers, and economists, who deal with forecasting and territorial development in the Northern regions.

**Key words:** Arctic, Nordic countries, development strategies, innovation, economic development, science, international cooperation.

The Arctic is a Northern polar region of Earth, it includes northern edges of the continents Eurasia and North America, the Arctic ocean with its islands, and the adjacent Atlantic and Pacific oceans. The Nordic countries have different approaches to defining the boundaries of their Arctic zones, and they are still not identified clearly [9].

The land territories of Russia that comprise the Arctic zone are established by the Decree of the President of the Russian Federation as of May 2, 2014 No. 296<sup>1</sup>.

At the beginning of the 21st century, countries located inside (Denmark, Iceland, Canada, Norway, Russia, the U.S., Finland, Sweden) and outside the Arctic zone (India, China, Japan, Singapore, South Korea), and their associations (the European Union) developed a strategy for the study of the Arctic and the Far North and now support it with funding. The basis of the documents is formed by concepts for sustainable socio-economic development, effective and integrated use of mineral, water, biological tourism and recreational resources, the study and modernization of coastal zones for the purpose of development of ports and coastal infrastructure, documents on the development of Arctic navigation, environmental issues, international cooperation in the framework of the Arctic Council, the Barents Euro-Arctic Council (BEAC), and the European Union (EU). The Nordic countries focus on scientific research, knowledge transfer, exchange of experience on the work in extreme conditions of the Arctic [8, 14, 16, 19-22].

The Arctic countries make efforts to diversify the economic base of the Northern

territories and expand their economic structure. This can be achieved in the framework of innovation policy implemented on the principles of strategic planning of public-private partnership in cooperation with industrial enterprises, research-educational and public organizations and with the help of international cooperation.

**Formation and development of innovation policy in the Arctic zone of the Russian Federation (the Russian Arctic).** This area covers over 9 million km<sup>2</sup>, of which about 6.7 million km<sup>2</sup> is water area, which accounts for 45% of the area of the Arctic Ocean. The length of the Arctic coast of our country is the greatest among countries with Arctic zones. The continental shelf within the Arctic sector is 6.1 million km<sup>2</sup> or 41% of the entire water area of the Russian Federation. We emphasize that approximately 5.1 mln km<sup>2</sup> (70% of the sector) of this area is permanently covered with ice and 1.5 mln km<sup>2</sup> (23%) – with perennial ice [1].

The Russian sector of the Arctic has natural resource (worth several tens of trillion US dollars), scientific and production and technological potential that can in the long term ensure socio-economic and innovation development of the country. It is involved in the production of 12% of GDP and generates about 30% of Russia's exports. The Russian Arctic is home to more than 2.5 million people, which exceeds half of the total population of the Arctic [1, 4].

<sup>1</sup> *Ukaz Prezidenta Rossiiskoi Federatsii "O sukhoputnykh territoriyakh Arkticheskoi zony Rossiiskoi Federatsii" ot maya 2014 g. № 296* [Decree of the President of the Russian Federation "About land territories of the Arctic zone of the Russian Federation" dated May 2, 2014 No. 296].

At present, from an economic point of view, the Arctic macro-region has single-industry resource-based specialization. The share of value added of extractive industries and businesses in the region reaches 60% (for comparison, in Greenland, in the Far North of Norway, Finland, Sweden and Iceland it is no more than 15%, in the polar regions of the U.S. and Canada – about 30%) [8].

The Russian Arctic, being an important region, is gradually becoming an independent public administration entity [15]. In 2008–2013, the following documents were developed and approved: the fundamentals of state policy of the Russian Federation in the Arctic for the period till 2020 and further perspective, the strategy for development of the Arctic zone of the Russian Federation and national security for the period till 2020 and a number of other documents<sup>2</sup>.

Knowledge, presence, and growth are key points of Russia's strategy. The document is based on the principle of increasing and accumulating competitive and scientific knowledge, investment and productive capacity in the most promising areas, in the centers that form clusters of socio-economic efficiency in the Arctic zone.

The strategy puts forward two ways of development of the Russian Arctic in the long

<sup>2</sup> The foundations of state policy of the Russian Federation in the Arctic for the period till 2020 and further prospect: approved by the President of the Russian Federation in 2008; the strategy for development of the Arctic zone of the Russian Federation and national security for the period up to 2020: approved by the President of the Russian Federation in 2013.

term: inertial and innovation. They differ in the nature of the hypotheses adopted in the formation of socio-economic trends; they also differ in internal and external factors and constraints, including random ones. They were designed in accordance with the policies of relevant ministries and departments of the Russian Federation, recommendations of the working groups of the Arctic Council, Arctic foreign policies and other documents [14].

*The inertial scenario* reflects the conflict of interests of the Arctic countries and the strengthening of their struggle for natural resources of the disputed areas, including the increased pressure against the presence of Russian companies in the Spitsbergen archipelago. This scenario reflects the prolongation of existing trends in key sectors of the Arctic economy and is based on conservative estimates of growth of key indicators. It is assumed that GRP growth rate in the territories included in the Arctic zone, real incomes, budget revenues, and productivity growth will be below the national average, and the expected structural shifts in the Arctic economy and the growth of investments will be slow. The contrasts between the development of the dynamic western and the depressed eastern sectors of the Arctic zone will increase<sup>3</sup>.

*The innovation scenario* is based on optimistic estimates of development of the

<sup>3</sup> The strategy for development of the Arctic zone of the Russian Federation and national security for the period up to 2020.

core sectors of the Arctic economy taking into account the implementation of investment projects. The scenario focuses on ensuring cooperation between the circumpolar countries in the development of mineral and fuel deposits on the Arctic shelf, which will provide a more rapid pace of their development in comparison to the inertial scenario.

Characteristic features of this scenario are, on the one hand, consistent implementation of competitive advantages of the Russian Arctic on the basis of its natural resource potential; on the other hand, the manifestation of a new quality of economic growth based on expanding the economic base of Russia's Arctic territories through increasing the influence of new industrial and information and communication services and technologies in various sectors of the Arctic economy. Implementation of the innovation scenario involves the development of human potential, modernization of scientific and technological and institutional environment, industrial, energy, and transport infrastructure, creation of manufactures for deep processing of natural resources for the purpose of obtaining products with high added value. The pace of development of the Russian Arctic is expected to be above the national average due to the implementation of mega-projects in the resource and transport-communication areas (key attention is paid to the development of the Northern Sea Route, overland railways and motor roads).

The first place in structure of the Russian Arctic belongs to the gas complex (it produces more than 80% of Russian gas), the second – to the mining complex with its centers in Norilsky District of Krasnoyarsk Krai and in the Kola Peninsula. Therefore, when implementing the innovation scenario special emphasis is placed on the development of mineral and fuel deposits, including those on the continental shelf of the Arctic seas. In this case, innovation should be implemented with a strict observance of ecological safety measures (precautionary approach). This activity should, on the one hand, be adapted to the heterogeneity of economic space of the Russian Arctic, and on the other hand, dictated by the desire to maximize the use of its competitive advantages.

The experience of Russia and foreign countries shows that the development of shelf resources is a knowledge-intensive process. Russia inherited the system of Arctic studies from the USSR and to date it has almost lost its leadership in their progress, it especially concerns the developments in the interests of socio-economic development of the Far North and the Arctic. However, our government is taking system efforts to create science policy in the Arctic region. This is reflected, for example, in the promotion of a system for organization of scientific research and development, participation of Russian universities in projects of the Network University of the Arctic, involvement of Russia in programs of the

International Arctic Science Committee, the use of the scientific center on the Spitsbergen Archipelago, cooperation in the working groups of BEAC, the Arctic Council, the EU program “Northern Dimension” [2, 5]. The Resolution of the Government of the Russian Federation from April 9, 2010 No. 218 “On measures providing state support to the development of cooperation between Russian educational institutions of higher education, state scientific institutions and organizations implementing complex projects on high-tech production, in the framework of the sub-program “Institutional development of the research sector” of the state program “Development of science and technology for 2013–2020” aims to promote innovation activities in the Russian Arctic. In our opinion, the document needs to be improved, because the cost of the projects is the most important criterion for evaluating the efficiency of work on the projects.

Innovation activity in the conditions of the Arctic economy is subject to the impact of a significant number of challenges that have to be addressed. Innovation trends in the development of resources on the Arctic shelf are characterized by the fact that at the present stage Russia is lagging behind its dynamic neighbors by 30–40 years with regard to the duration, techniques and technology of production of hydrocarbons on offshore fields. Among the challenges we name macroeconomic, financial, climatic, environmental, energy, infrastructure, socio-

demographic, personnel, legal, informational and other ones. It should be noted that investment in exploration and mining, especially offshore, are long-lasting.

In 2014, in respect of the Russian industrial and financial corporations, the EU, Norway, USA, Canada, Australia and other countries imposed sanctions, which apply to the oil and gas industry as well. The restrictive measures prohibit the sale, supply, transfer or export of technology, equipment and services if there is reason to believe that they will be used for exploration and production of oil and gas, including that on the Arctic shelf.

Despite this fact, leading foreign companies remain interested in the development of the Arctic coast and offshore resources and it is often being done with the involvement of innovation technology. According to Russian legislation, Rosneft and Gazprom – the companies with state participation operating in national interests and possessing technology and experience of work in harsh climatic conditions of the Far North – are permitted to work on the Arctic shelf. Over 80% of licenses for development of hydrocarbon deposits in the Barents and Kara seas within the boundaries of the Timan-Pechora and West Siberian oil and gas provinces are distributed between these two companies. They are involved in the resource exploration of the Shtokman field (Gazprom, Total), Novaya Zemlya areas in the Kara (Rosneft, British Petroleum) and Barents seas (Rosneft, ExxonMobil, ENI).

NOVATEK and Total are developing the Yuzhno-Tambeyskoye gas field on the Yamal Peninsula. Chinese investment funds are involved in the development of a project on the construction of the Belkomur railway. Vietnamese companies are allowed to explore and develop oil and gas fields in the Nenets Autonomous Okrug [3].

**Innovation rating of the Arctic regions of the Russian Federation.** In connection with the planned implementation of the innovation scenario, it is of interest to consider the innovation development rating of constituent entities of the Russian Federation. The rating is compiled by the Institute for Institute for Strategic Studies and Economics of Knowledge at the National Research University “Higher School of Economics”. For this purpose, the following sources are used: official statistics (Rosstat), bibliometric and patent information, records of the Federal Treasury, open data of public authorities of constituent entities of the Russian Federation<sup>4</sup>.

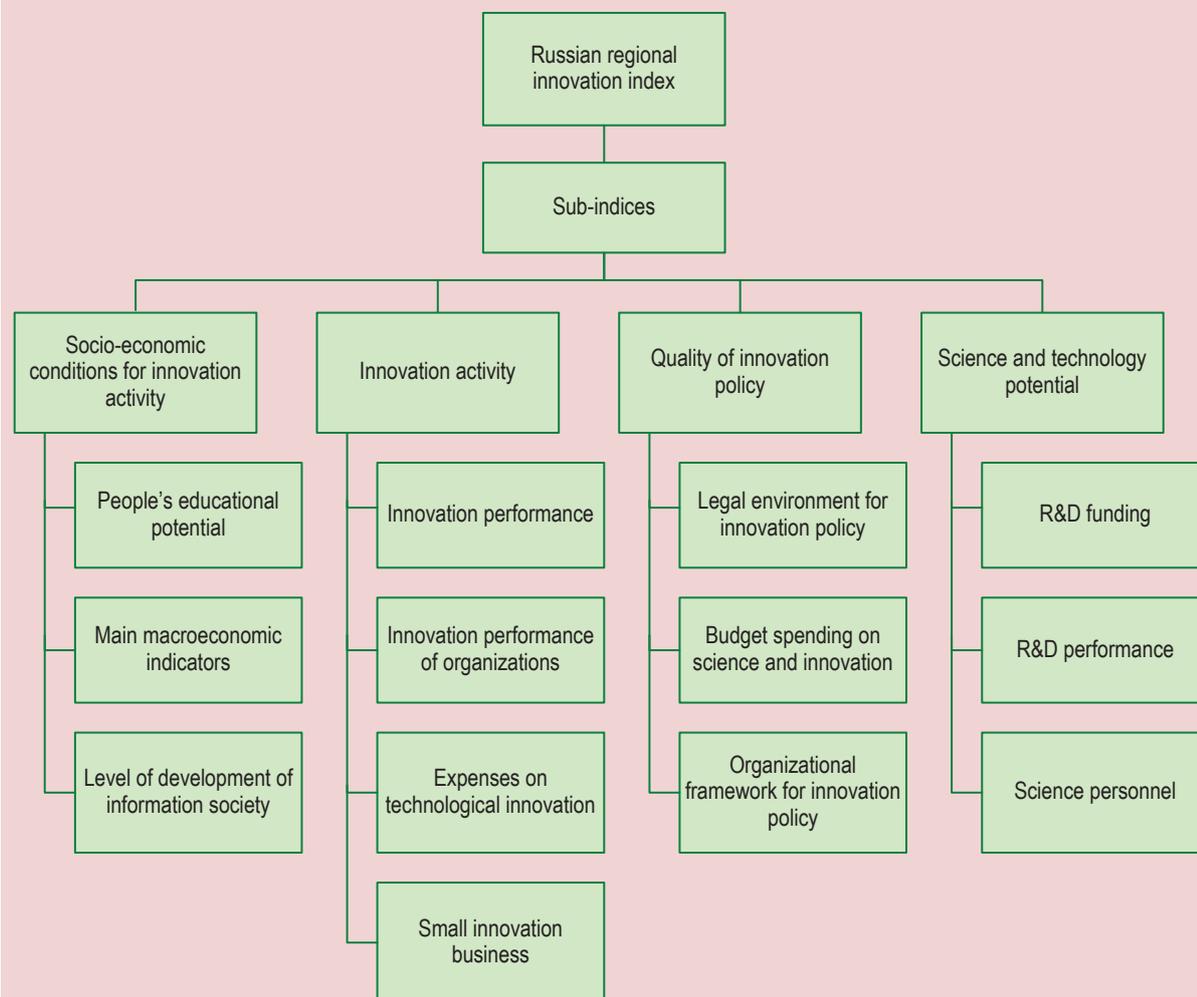
The structure of the Russian regional innovation index is presented in *Figure 1*. The index is based on sub-indices that characterize major areas of innovation activity: *socio-economic conditions, science and technology potential, innovation activity and its productivity, and the quality of innovation policy*.

<sup>4</sup> Gokhberg L.M. (Ed.). *Reiting innovatsionnogo razvitiya sub'ektov RF. – Vyp. 3 i 4* [Innovation development rating of RF constituent entities. Volumes 3 and 4]. Moscow: NIU VShE, 2015, 2016. 248 p.

*Table 1* presents the position of constituent entities of the Russian Arctic in 2012–2014 in this ranking. Taking into account specific features of statistical observation, we cited the data for the entire subject relating to the Arctic zone of the Russian Federation.

Analyzing these data, we can note the stability of innovation activity in the regions of the Russian Arctic zone and point out that the changes in 2012–2014 were insignificant. The Republic of Sakha (Yakutia) and Yamalo-Nenets Autonomous Okrug (YNAO) are leaders in the positive dynamics, the former has moved up to the 16th place and the latter – to the 13th place. This may be attributed to the government’s increased attention to science and technology policy, the high level of qualification of human resources, interaction between industry, small business and science, which aims to improve the efficiency of local nature management. The YNAO implements projects with international participation in the exploration of mineral resources and development of transport infrastructure, which promotes investment and the use of advanced technology in extreme climatic conditions of the Arctic. In Yakutia, multidisciplinary scientific-educational complexes involved in the development and implementation of advanced technology play an important role. Such complexes comprise technology parks, venture companies, state agency for coordination of innovation activities, the Arctic Innovation Center of the North-

Figure 1. Structure of the Russian regional innovation index



Source: Gokhberg L.M. (Ed.). *Reiting innovatsionnogo razvitiya sub"ektov RF. – Vyp. 3 i 4* [Innovation development rating of RF constituent entities. Volumes 3 and 4]. Moscow: NIU VShE, 2015, 2016. 248 p.

Eastern Federal University. For the purpose of designing a scientific and innovation system for sustainable socio-economic development of Yakutia, the state program “Scientific, technological and innovation development of the Republic of Sakha (Yakutia) for 2012–2019” has been in operation since 2011.

The main reasons hindering the development of innovation in the Arkhangelsk Oblast and in the Komi Republic, the regions whose positions in the analyzed rankings deteriorated by 25 and 11 points respectively, can be as follows: lack of financial resources (in contrast to the Republic of Yakutia,

Table 1. Ranking of the subjects of the Russian Arctic by the Russian regional innovation index (2012–2014)

| Constituent entity                    | Rank |      |      |
|---------------------------------------|------|------|------|
|                                       | 2012 | 2013 | 2014 |
| Yamalo-Nenets Autonomous Okrug (YNAO) | 39   | 34   | 26   |
| Arkhangelsk Oblast                    | 38   | 55   | 63   |
| Komi Republic                         | 30   | 36   | 41   |
| Murmansk Oblast                       | 40   | 43   | 37   |
| Krasnoyarsk Krai                      | 16   | 12   | 12   |
| Republic of Sakha (Yakutia)           | 60   | 55   | 44   |
| Chukotka Autonomous Okrug             | 77   | 75   | 73   |
| Nenets Autonomous Okrug               | 80   | 79   | 80   |

Source: Gokhberg L.M. (Ed.). *Reiting innovatsionnogo razvitiya sub"ektov RF. – Vyp. 3 i 4* [Innovation development rating of RF constituent entities. Volumes 3 and 4]. Moscow: NIU VShE, 2015, 2016. 248 p.

where grants from the President of the Republic are allocated every year on the formation of innovation infrastructure and on research and technology transfer), lack of qualified personnel and the outflow of working population (according to government statistics, more than 100 thousand people have left the Arkhangelsk Oblast since 2000), depreciation of production facilities, poor development of transport and social infrastructure. In order to change the situation for the better, we believe it would be appropriate to study in more detail and to use the experience of innovation in Russia's successful regions including Yakutia and Yamalo-Nenets Autonomous Okrug. Here it is necessary to take into account similar geographical and climatic conditions, natural resource potential, research infrastructure and the industrial structure of the economy, and to complement the missing elements of the regulatory framework. We note that in the

Arkhangelsk Oblast in 2015–2017 certain steps were taken to promote innovation activity in the real sector of the economy, which resulted in the creation of clusters in the timber industry and mechanical engineering.

The possibility of forming an innovation-oriented economy based on the implementation of projects in the mineral resources sector is shown by the experience of development and implementation of innovation policy in the advanced Nordic countries.

**Approaches to shaping innovation policy in the Nordic countries.** The Nordic countries occupy top positions in innovation ratings. Denmark, Sweden, and Finland are recognized as most-innovative economies in the 2013–2016 rankings in the Global Innovation Index, released by Cornell University, INSEAD and the World Intellectual Property Organization (*Tab. 2*).

Table 2. Russia and the Nordic countries in the Global Innovation Index 2013–2016

| Country | 2013 | 2014 | 2015 | 2016 |
|---------|------|------|------|------|
| Denmark | 9    | 8    | 10   | 8    |
| Sweden  | 2    | 3    | 3    | 3    |
| Finland | 6    | 4    | 6    | 5    |
| Iceland | 13   | 19   | 13   | 13   |
| Norway  | 16   | 14   | 20   | 22   |
| Russia  | 62   | 49   | 48   | 43   |

Source: Global Innovation Index. INSEAD. Cornell University. World Intellectual Property Organization. 2013, 2014, 2015, 2016. Available at: <https://www.globalinnovationindex.org>.

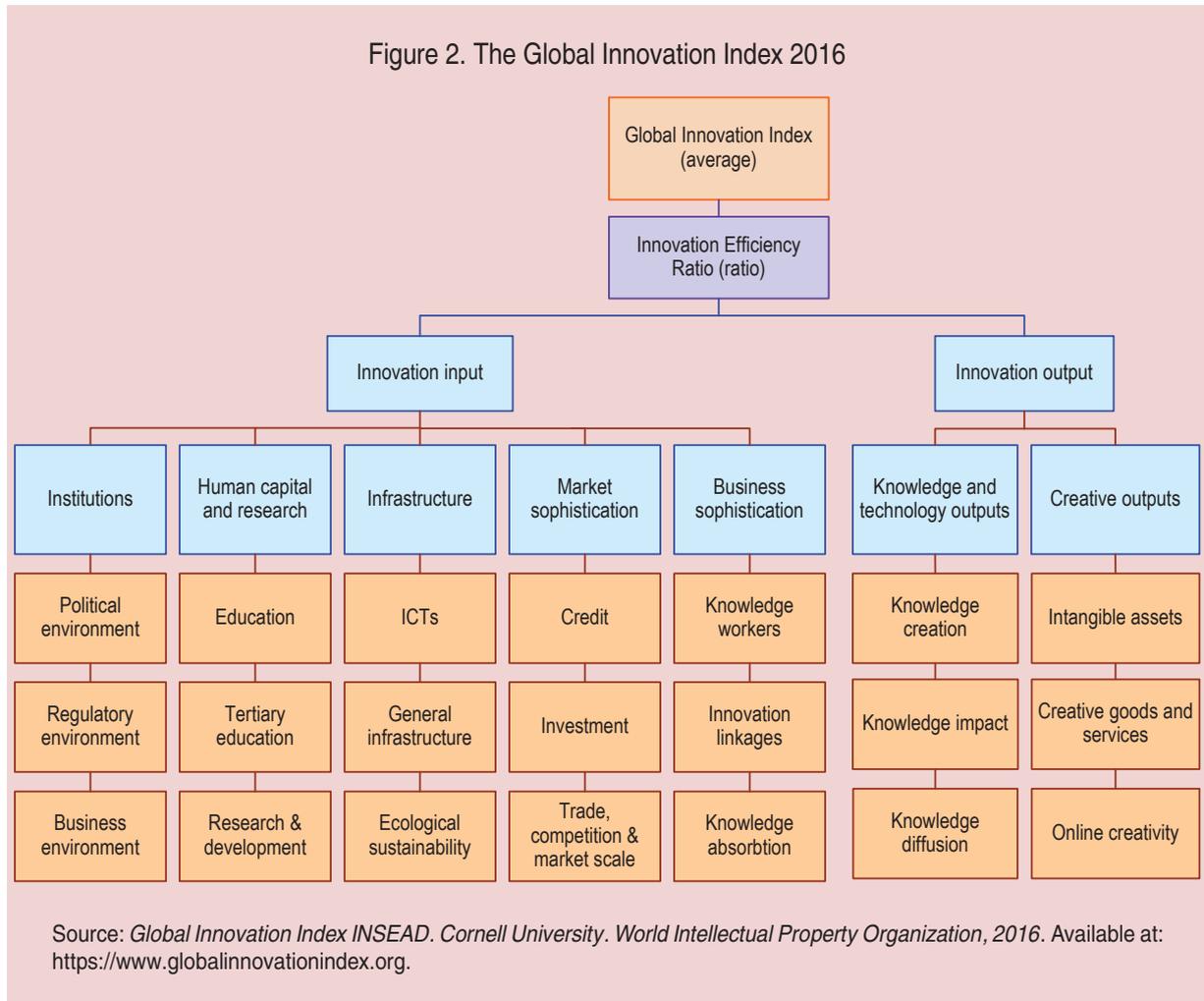
The same can be said about the positions of these countries in the Innovation Union Scoreboard of the European Commission and in the Global Competitiveness Index issued by the World Economic Forum and covering over 150 countries. This takes into account basic requirements (development of social institutions, health and education systems, infrastructure, macroeconomic stability), innovation and sophistication factors (business sophistication, current innovations), and efficiency enhancers (higher education, goods and services market efficiency, labor market efficiency, financial market development, technological readiness, domestic market size).

*Figure 2* demonstrates the structure of the Global Innovation Index (2016).

The high level of innovativeness in the Nordic countries can be due to several reasons. Sweden, Finland, Norway, Denmark and Iceland form their national innovation policies taking into account their geographical position, encouraging the development of labor resources, developing the education

system, scientific research and development. By embedding in the political and geographical processes on the European continent and by implementing the potential of regional cooperation, these countries have become leaders in fields that shape their international specialization. The economic and geographical status of “small countries” is an advantage of the Nordic countries [6].

The concept of “national innovation system” developed by Swedish professor B.-Å. Lundvall forms the basis of economic, scientific, technological and innovation policy in many EU countries. Idea of innovative development of regions and the concept of “learning regions” developed by Norwegian economic geographers B. Asheim and A. Isaksen. The concept of “knowledge society”, which is now widely used, was coined by American economist M. Castells, and Norwegian researcher K. Sogner elaborated it and developed the concept of “innovation culture”, this concept is a distinctive feature of the Nordic model of socio-economic development. The



Swedish school of the distribution theory and K. Wicksell’s (1851–1926) theory of the “cumulative process” of inflation contributed to the development of global economic theory and practice. G. Myrdal (1898–1987) developed an institutional theory for overcoming economic backwardness. Swedish economists E. Heckscher (1879–1952) and B. Ohlin (1899–1979) revealed a correlation between national production costs with factor advantages of countries by explaining the principles that determine export production

specialization of countries and serve as a basis for the theory of international division of labor. The development of socio-economic thought and practice was influenced by concepts of Swedish trade union leaders and social democrats. The developments of G. Rehn and R. Meidner still serve, though not indisputably, as a theoretical basis for regulating the labor market in a socially oriented market economy and are used in the concepts of the “welfare state” in Sweden and Finland. Labor resources have not

only the ability to obtain and analyze new information, but also the ability to acquire new competences, in other words – the self-education ability that enhances the creative nature of employment [10].

The government plays an important part in the process of creation and implementation of innovation. It consists in the formation of policies, programs and institutions that shape the goals, objectives, resources, and areas of innovation activities.

Innovation policies of the Nordic countries are based on government-controlled policy in the field of science. Most of the work in this direction is performed in Sweden by the Ministry of Education and Research jointly with the Ministry of Enterprise and Innovation, in Norway by the Ministry of Trade, Industry and Fisheries and the Ministry of Education and Research, and in Finland by the Ministry of Education and Culture and the Ministry of Economic Affairs and Employment.

The tradition of invention can be named as one of the reasons for the development of innovations in the Nordic countries. Their basic science and applied engineering made a significant contribution to the creation of technology that brings industrial society to a new stage of development.

The Nordic countries are world leaders by the UN Human Development Index [10], i.e. they have high indicators of development of higher and postgraduate education. According to the data for 2012, Norway and Denmark

spend more than 4% of GDP on education, given an average global rate of about 3% (in Russia as well). However, despite the fact that the Arctic countries are paying serious attention to provide their circumpolar territories with qualified personnel, higher school in this region is developed unevenly. This can be explained, in particular, by the different degree of development of territorial and sectoral structure of the economy and infrastructure of the Northern territories [18].

In Sweden, with the government support (innovation systems management) focuses on the development of scientific-production centers and clusters. These include, for example, an innovative-technological cluster in Kista, an automotive cluster in the Gothenburg, the biotech cluster “resund” in the South of the country on the border with Denmark and in cooperation with its universities and enterprises. In these facilities, the governmental Triple Helix Model is formed. It is based on three high-tech development actors: the government, business and universities, which stimulate innovation that improves the quality of life and the state of the environment at the regional level. However, a risk of development of innovation system consists in the development of high-tech industries only in multinational companies (such as Ericsson, AstraZeneca, SKF, TETRAPACK, Volvo). The success of most companies in “old” industries (mining, food) is associated with the use of traditional technology. Commercialization

of research findings is characterized by insufficient development of stimulating tax policy in investment activities, which hinders the development of high-tech economic. However, Sweden and Finland are European leaders by the share of R&D expenditures in GDP [10].

In a comparative perspective we can point out that when executing the instructions of the President of Russia in 2012 the Government of the Russian Federation selected only the Arkhangelsk region among all the territories of the Russian Arctic and included the Arkhangelsk shipbuilding cluster in the federal list of innovative territorial clusters. The cluster is created on the basis of enterprises in Severodvinsk and includes the objects of federal and regional scientific and production infrastructure (engineering enterprises, institutions of higher and secondary professional education, centers for research, development and transfer of technology, centers for collective use of scientific equipment). The cluster specializes in designing and making the equipment for exploration and production of oil on the Arctic shelf (e.g., parts for the Prirazlomnaya offshore ice-resistant stationary platform and assemblies for floating nuclear power plants) and testing power devices used in marine shipbuilding and adapted to the arctic conditions (for example, electric podded azimuth thrusters AZIPOD for ice-class vessels).

Since 2016, the Arkhangelsk Oblast has been forming a timber industry innovation territorial cluster “PomorInnovaLes”, which comprises more than 40 participants, including leaders of the lumbering and pulp and paper industry, as well as transportation and logistics, educational and research organizations. The purpose of the association of enterprises is to strengthen leadership in Russia on deep processing of wood and production of competitive products with high added value. The cluster includes, in particular, Arkhangelsk Pulp and Paper Mill, logging enterprises of the region, JSC Northern Shipping Company, JSC Arkhangelsk Sea Commercial Port, JSC Solombala Machine-Building Plant, OOO Arkhbiofarm, Northern Research Institute of Forestry, Northern (Arctic) Federal University named after M.V. Lomonosov, and others. In 2016 an agreement was signed between the companies of the cluster and the Natural Resources Institute Finland; the agreement reflects the need for joint work on sustainable use of forest resources in the Northern districts of the two countries. Priority is given to implementation of advanced technology in the forest inventory, road construction, landscape planning, cultivation of planting material with the best genetic characteristics to increase the social responsibility of business and development of bioeconomy. At the current stage of development of Russian clusters it is premature to analyze

their work; however, there is reason to expect improvements in the positions of the Russian Arctic regions in innovative development rankings. Formation of innovative regional clusters in Russia is stipulated by the Strategy for innovation development for the period up to 2020 and based on the international experience including that of the Nordic countries.

Strategic areas for development of innovation in Finland are determined by the Finnish Funding Agency for Technology and Innovation and by the Technical Research Centre of Finland in cooperation with the Academy of Sciences, with universities, and the business community. A specific feature of the national model for innovation support consists in the fact that it focuses on the development of infrastructure presented by research clusters under universities (e.g., the New Factory on the basis of Tampere universities). Against the background of competition with Asian and North American producers of electronics, Finland pays much attention to the development of R&D in information technology, telecommunications, electrical engineering (e.g. Nokia), which are currently the basis for the development of its economy.

In an innovative aspect, Norway differs from other countries of the Arctic region, because it focuses on exploitation of resources, around which the specialized areas of the high-tech sector of the national economy are formed. Innovation policy at the

state level is formed by the Research Council of Norway, the company Innovation Norway, and the Industrial Development Corporation of Norway. The implementation of research projects and the use of differentiated taxation stimulate developments and their implementation by mineral developers, which reduces the cost of field development and contributes to the preservation of the environment. Research and investment are focused on providing safe deepwater drilling of oil and gas wells on the continental shelf, the development of monitoring systems of deposits of energy carriers. Success in these areas can stimulate the development of shipbuilding industry, clean technology, renewable energy, information and telecommunication technology. On the background of high development levels of human capital, markets for goods, labor and finance, Norway has relatively low levels of investment and development of related infrastructure [6]. This fact is often denoted as the Norwegian paradox, the essence of which consists in the following fact: economic performance is strong and incomes are high despite low innovativeness [17].

In Iceland, the innovation management system and related scientific research began to take shape after the financial crisis of 2008, when the government developed a plan to diversify the economy, involving, among other things, an increase in the share of manufacturing industries and the services sector in GDP. Currently, innovation policy

is developed by the Ministry of Education, Science and Culture, Ministry of Industries and Innovation and several other structures connected with universities and enterprises engaged in shipbuilding, alternative energy, fishery and biotechnology.

Over the last 20 years, due to the revision of its science and technology policy, Denmark has formed an institutional environment for innovative development. Currently, the Danish economy engages in vigorous creation and translation of new knowledge, application of venture capital and cooperation between economic agents. Innovation policy is managed by the Ministry of Higher Education and Science, the Agency for Education, Science and Innovation, the Danish National Research Foundation and others. The innovation strategy of Denmark (2015) declares the following key directions of innovation policy of the country: development of cooperation between business and research institutions, access to highly skilled labor force, development of technological services, and commercialization of research. At the state level, the research in the areas of alternative energy, transportation, environmental protection, improving the quality of urban environment, development of food industry, public health, information and communication technology is recognized as promising.

Thus, the purpose of the state innovation policy in the Nordic countries is to establish conditions conducive to the development of

human potential to ensure sustainable and integrated socio-economic development of territories on the basis of accelerated transition to the balanced development of services and industries, creation of mechanisms providing support to scientific and technological progress, stimulation of existing clusters and creation of new ones.

The analysis of the experience of innovation development in the Nordic countries demonstrates national characteristics of their development and implementation that are due to a differentiated resource base: development strategies of these states, the structure of their economies, human capital, organization of science policy, intellectual resources, world trends in the development of markets for goods and services. Common features of innovation policy are as follows: promoting the development of knowledge-intensive industries, modernization of training and retraining systems, participation of education, science, public authorities and business in the development of infrastructure and promotion of research and development. This contributes to the early introduction of developments in production and their commercialization.

It should be particularly noted that the research approaches and findings concerning the Arctic region are used in determining the geopolitical aspirations and technological innovation policy of the Nordic countries. It provides breakthrough solutions with quick financial and organizational support,

thus the progress in research is achieved and its findings are quickly implemented into production [5].

In conclusion, we note that currently researchers and experts in various fields of science and practice are becoming more and more interested in the Arctic. The increased attention to the Arctic is connected with economic globalization, decreased production of mineral raw materials and fuel in the traditional areas, development of intercontinental transport routes, the need to ensure sustainable development in the vast regions and sea areas that have not been exploited previously. At the end of the 20th century and the beginning of the 21st century, the Arctic undergoes system and rapid transformation, which develop in conditions of lack of knowledge concerning their causes and consequences. An example can be found in climate change, which entails an unprecedented decrease in the seasonal minimal levels of sea ice, improvement of conditions for the exploration and exploitation of minerals, and clearing out the ice along transport routes [12].

The search for answers to the challenges of natural resource development in the Arctic zone is possible with the help of innovation policies when using the experience of neighboring circumpolar countries. The Nordic countries are world leaders in the development and application of innovative technology in all spheres of the economy and non-manufacturing sector. They top

global innovation rankings. An important precondition of transition to an innovative type of development was the change in the paradigm of state economic policy in the early 1990s. This resulted in a gradual decline in the share of primary industries in GDP. As for international specialization, the Nordic countries shifted to the provision of services based on science-intensive technology and informatization. This is a qualitative difference between the vector of development of the Nordic countries and that of Russia. Studies show that the growth of industrial production in the Russian Arctic is facilitated mainly by extensive factors, such as increasing the volume of extraction of natural resources rather than the use of innovative technology [13]. Innovation policy in the constituent entities of the Arctic zone of the Russian Federation are developed, with rare exceptions, insufficiently and, as a consequence, Russia lags behind the Northern countries in innovative activity rankings, even though it is in similar geographical conditions.

The issue concerning the transfer of innovation activity experience of the Nordic countries to the Russian conditions cannot be solved unambiguously. On the one hand, it is important to consider similar geographical, climatic conditions and natural resource potential, population settlement, industrial and territorial economic system of the Northern regions of Europe and Russia. On the other hand, applying even the most

progressive foreign experience of economic development in another state is ineffective. It requires a deep study, taking into account national characteristics, knowledge of the quality and mentality of the local workforce, the institutional environment and regulatory framework that will undoubtedly vary in different countries.

A.N. Pilyasov considers the Arctic as a research laboratory, a territory of discoveries, a vast area for innovative search. He writes: “The Arctic zone of Russia is a major testing ground for the development of fundamental and applied research in various fields of knowledge... For this purpose, Arctic communities have numerous favorable conditions... Murmansk, the largest city in the Arctic, and other Russian Arctic cities can become intellectual platforms for a new economy based on knowledge and innovation” [7].

Today the status of the Arctic power is not given automatically, based only on specific geographic location. Priority efforts should be directed at research and innovation. Our country, relying on its own rich historical experience, using advanced technology of its neighboring circumpolar countries, is to radically upgrade the infrastructure, including science (especially in the sphere of

offshore development and forecast of climate change), transport (especially land), housing and utilities sector. This may be achieved by using membership in international organizations, which provide opportunities for sharing economic experience in the high latitudes and competences of labor resources and participate in collaborative interdisciplinary research, development of academic and scientific mobility in the Northern universities, as well as creating conditions for attracting direct foreign investment. In the interests of development of the Russian Arctic territories it is necessary to give more attention, as is done in the neighboring countries, to the Arctic field of intelligent service. It covers economic activities, including polar hydrography, monitoring climate change and ice conditions, modernization and development of a network of ground and space satellite observations of climate and the condition of Arctic ecosystems. In such services around the world new jobs are created and scientific authority is earned, this service acts as a client and consumer of innovative research findings. We believe that it is most appropriate to synthesize advanced foreign experience and Russia accumulated knowledge in this very sphere.

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