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Assessment of possibilities and mechanisms of innovation development of the regional economy*

The article dwells on the problems and directions of innovation policy at the federal and regional levels. It is based on the methods of system analysis and expert estimations. The authors prove that it is industrialization that will be the most important factor of scientific and technical progress in the coming years. The capabilities of innovation processes in the North and in the Russian Arctic are analyzed and presented on the basis of expert estimations and forecast trends, among other things.

Strategy, economic processes, development, innovation, the North and the Arctic, industrialization, forecast, expert estimations.

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The Strategy for the development of the Arctic zone of the Russian Federation and national security for the period up to 2020 assumes significantly increased attention to innovation factors of the industrial modernization. In particular, the main threats and risks to socio-economic development are the following: high energy intensity and low efficiency of natural resources extraction, increased costs of the northern production, lack of modern technical means and technologies for search, exploration and development of offshore hydrocarbons in the Arctic conditions, etc.

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In this regard, the measures on state support and stimulation of the economic entities operating in the Arctic zone of the Russian Federation, primarily in the field of the development of hydrocarbon resources, other minerals and aquatic biological resources through the introduction of innovation technologies, the development of transport and innovation infrastructure, are to be elaborated and implemented. It is proposed to stimulate the realization of new projects on the economic development of the Arctic territories by the co-financing out of the budgetary sources of the different levels of the Russian Federation budget system and non-budgetary sources.

In the context of the national plan, it is industrialization that is noted to be the main landmark for the country's economic development. The extent of the 'deindustrialization' of recent years is simply disastrous: while in 1990 Russia accounted for more than 90 thousand of machine tools (including 20 thousand of numerical control machines), in 2012 the country produced only 5 thousand items. Machinery deterioration exceeds 70%.

In these circumstances, it is necessary not only to restore the industrial potential within the fourth technological mode, but also to implement actively the innovation dynamics in the fifth mode. When briefly formulating the conceptual problems of the selection, necessitating Russia's innovation development in the strategic plan, the alternatives are the following:

• spontaneous 'sliding' of the model into 'semi-colonial' economy, which means the consolidation of the country's role as the world's raw materials appendage;

• passive acceptance of standards of conduct and 'participation' in the division of labor, emanating from transnational institutions, considering Russia's interests to a minimum degree;

• reasonable choice of the national strategy for innovation industrial development, suggesting the rightful participation of the country in the formulation and solution of global and national problems;

• elaboration of the proper vector of industrial development due to the preservation of competitive advantages of the resource-based sector, on the one hand, and gradual transition to a new technological mode, based on import substitution, among other things, on the other hand.

The implementation of the last two principles of the strategic choice for the Northern regions will denote the policy of innovation industrialization, differentiated depending on natural-resource potential, and based on the coordination of interests and partnership of the federal and regio-nal authorities, industrial corporations and infrastructure enterprises on construction, transport, etc.

In this regard, the main research objective of the article is to analyze the specifics of the production complex of the Russian North from the positions of industrialization, and to evaluate the opportunities for its dynamics on the basis of innovation. Accordingly, it is proposed to solve the following tasks:

• to consider the need for and features of the national economy industrialization;

• to identify the major constraints and risks for the management in special climatic conditions;

• to analyze statistical data and expert estimates concerning investment and innovation processes in the country's Northern regions;

• to evaluate (draw conclusions) the opportunities for and factors in the innovation development of the regional economy.

Obviously, the Northern regions will retain the raw-material orientation with rather high gravity of export products in the foreseeable future. Possible to increase The production of liquefied natural gas is likely to grow, while some increase in manufacturing industries, in

particular shipbuilding and ship repair, will be observed in the European part. Such strategy, focused on the real demand, complies with the prospective conditions of the global industrial cooperation with long-term conservation of or even increased demand for relevant types of raw materials. At the same time the prospects of raw material orientation of the industrial sector of the Northern regions have certain restrictions and risks that should be considered when forecasting the trends of innovation industrialization:

1. Higher production costs, caused by high labor costs and additional transportation, energy, and other cost types. This can be a significant negative factor in the conditions of increasing international competition.

2. High fluctuation of global commodity markets, caused by growing demand in developing countries, on the one hand, and by the policy of resource conservation, implemented almost everywhere, on the other.

3. The trend of decline in profitability of the commodity sector, due to deteriorating conditions of production, increasing environmental constraints and the rate of deductions for environmental protection.

4. Strategic risks, associated with the constant improvement of opportunities and indicators of transition to alternative types of resources have been growing. This applies first of all to fuel and energy sectors, and, to a lesser extent, to metallurgical sectors.

It is innovation modernization of the resource sectors of the North and the Arctic that will be one of the main factors reducing the risks. In this regard, the fundamental importance is to provide domestic science and technology complexes and enterprises with the orders for new equipment. The Strategy for the development of the Arctic zone of the Russian Federation, which have been already mentioned, stipulates the promotion of sustainable solvent demand for high-tech products, innovation technologies, materials and services in the Arctic zone of the Russian Federation, taking into account the necessity of the formation of the infrastructure when extracting hydrocarbon materials, particularly by improving state procurement system, the procurement system of companies with state participation and the subjects of natural monopolies. It is important to ensure the demand is supplied by domestic producers, based on import substitution, among other things [1].

As for new projects, the investment attractiveness of the Northern and the Arctic regions, in particular, constantly occupy the leading position. Thus, indices of investment competitiveness exceed 1 in most of the regions, make 3.8 in Khanty–Mansi Autonomous Okrug, and 4.1 in Chukotka Autonomous Okrug. Investment competitiveness determines the potential, i.e. the ability of the regions to compete (natural resources, labor potential, transport and energy infrastructures, etc.), while investment activity *(tab. 1)* determines how this potential is used [2].

As the second criteria shows, the Northern and Arctic regions are leading across the country, taking the first five places. This suggests that the industrial production of the resource sectors is the leading ordering customer of the new high-tech equipment.

Under fierce competition in external markets, one can assume that the most effective will be the process of industries development, primarily aimed at securing the country's large internal market, based on import substitution, among other things. It is necessary to create such conditions, in which the leading industries (resource ones in our country) will simultaneously act as 'cluster-forming' links, that is they will produce orders and 'drag along' supplying spheres and enterprises (machine-building, metallurgy, electronics, chemicals, etc), which will be given some preferential

Table 1. Change on the regions' positions in terms of investment activity

Region	Position (the lower the number, the higher the investment activity)					
	2004–2005	2005–2006	2006–2007	2007–2008	2008–2009	2009–2010
1	2	3	4	5	6	7
Nenets AO	1	1	1	1	1	1
Yamalo-Nenets AO	2	2	2	2	2	2
Sakhalin Oblast	3	3	3	3	5	5
Khanty-Mansi AO	4	4	4	4	4	3
Chukotka AO	5	5	7	7	6	6
Republic of Sakha (Yakutia)	13	10	6	6	3	4
Komi Republic	8	6	10	10	7	8
Murmansk Oblast	36	**26**	**55**	55	36	48
Magadan Oblast	48	60	64	64	**40**	**21**
Arkhangelsk Oblast	17	**15**	**46**	46	61	71
Kamchatka Krai	**67**	**19**	63	63	**33**	**14**
Republic of Karelia	**25**	**47**	66	66	73	79

advantages within the state programmes, on the one hand, and which will have no other choice but to raise their standards, competing with foreign manufacturers, on the other. That is the concept of the 'third' industrialization, the way the authors view it.

It is obvious that the Northern and Arctic regions will take specific position in the process of innovation industrialization. Machine-building (including machine-tool) factories will not be built here, as it is not economically profitable due to the increased cost caused by special economic conditions. However, the efficiency of the resource-based sector should sharply increase owing to the set of measures on advancing the extraction and processing depth of raw materials. The important thing is that extractive industries and corporations with vast financial resources at the first stage of industrialization can and should act as strategic customers of equipment and new technologies by processing industries [3].

It is extremely important that the whole system of innovation activity financing and scientific and technical activity commercialization is being actively formed at present. It includes involving the federal and regional target programmes, Russian Venture Company, Seed Fund, Corporation 'RUSNANO', etc.

However, 'integration' of federal and regional links still remains the weak point for at least two reasons. First of all, the regions often lack funds necessary for equity participation in projects. Secondly, scientific and technical potential of the majority of the RF subjects has significantly decreased during the reform years, it lacks the necessary infrastructure, experimental base, etc. [1].

At the same time, all territorial systems have their own characteristic features. Thus, the number of research personnel in the Northern economic region has decreased by more than 30% for the last 15 years, however, in the Vologda Oblast it remained almost unchanged, while in the Arkhangelsk Oblast the number even increased. When considering the indicators characterizing the level of innovation development of the Northern regions in general, it can be noted that the share of organizations implementing technological innovations out of the total number of organizations practically corresponds to the average Russia's indicators. However, the volume of the produced innovation products out of the total volume is 3 times below, which is explained by the fact that the Northern industrial enterprises are mainly consumers, rather than suppliers of technology transfer *(tab. 2)* [4].

Table 2. Main indicators characterizing the level of innovation development of the Northern regions in 2009. [5]

Region	Share of organizations implementing technological innovations, %	Share of innovation products, works, services, %	Number of filed patent applications per 10000 research fellows	Number of granted patents per 10000 research fellows	Share of personnel engaged in research and development, % of the total workforce	Share of employees with academic degrees out of the total number of the personnel engaged in research and development, %
Republic of Karelia	10.0	0.8	5.3	3.1	0.5	38.1
Komi Republic	9.7	4.7	5.1	4.7	0.4	35.4
Arkhangelsk Oblast	8.0	0.1	7.0	7.3	0.5	7.1
Murmansk Oblast	7.9	0.2	6.8	8.2	0.5	49.6
Regions of the European North	9.0	1.6	6.2	5.5	0.5	31.1
Russian Federation	9.4	5.0	26.9	5.3	1.1	26.9

The target-oriented approach is non-alternative in the conditions of insufficient means, with regard to the mechanism of the industrial innovation policy in territorial systems. It is considered the most relevant for the development and implementation of complex regional programmes, which determine the complex of activities, coordinated by resources, performers and time frames.

This complex comprises economic, technical, industrial, research, and business activities, which should involve many industries, sectors of activity and the regional authorities, which altogether allow a certain scientific and technological or socio-economic problem to be solved.

In order to make estimates for the forecast of innovation industrialization, an expert survey was conducted among the participants of the conference 'The North and the Arctic in the new paradigm of world development' (Luzin Readings – 2012), which was held in April 12-14, 2012 in Apatity. Qualified composition of participants comprised 7 Doctors of Science, 16 Ph.D. in Sciences and 5 members with no scientific degree; five participants work in higher educational institutions, nineteen are from scientific organizations, two are engaged in production, and two work in state administrative agencies [6].

Most of the issues were devoted to the possibilities and problems of the innovation economic development of the region. For example, it was suggested to score hindrances to mutually beneficial cooperation between science and business (5 points, if the hindrance is maximal). The differentiation is very high, as follows from the scoring, presented in *table 3.*

The authors have not determined positions (1 to 10) intentionally, in order to demonstrate that the clarity of assessments is actually very low and almost all the hindrances got the score of higher than 3, i.e. above average. The only option that scored below 3 is 'price of scientific developments prohibitively high for business'; nevertheless, the point of 2.96 is rather high. This assumes that the distribution is not normal, while the displacement to the right side is considerable (all kinds of hindrances were estimated as high enough).

The top three hindrances are the following:

1. High degree of risk – 4.08.
2. Weak business demand for innovations – 3.96.
3. Inactive position of the authorities on cooperation support – 3.96.

Table 3. Assessment of the opportunities and problems of the innovation economic development of the Northern region

Hindrance	Scoring					Average score
	1	2	3	4	5	
Both parties lack the need for cooperation, and are willing to do everything themselves	2	3	9	6	5	3.36
Lack of information on potential opportunities for cooperation between science and business	3	4	6	8	5	3.31
Scientists lack information about the requirements of business for innovation	5	4	4	9	4	3.12
Lack of knowledge concerning forms and methods of cooperation	1	4	11	7	3	3.27
Low level of trust in partners	3	3	5	6	14	3.81
Price of scientific developments prohibitively high for business	5	6	4	7	4	2.96
Weak business demand for innovations	3	1	3	6	13	3.96
Inactive position of the authorities on cooperation support	1	3	4	7	12	3.96
Poor protection of property rights for innovation products	3	2	3	9	9	3.81
High degree of risk	2	-	4	7	12	4.08
Other (specify what)						

When answering the question: 'In your opinion, what are the key external obstacles to the innovation activity of the industrial enterprises of the Murmansk Oblast? (multiple choice option)', the distribution of opinions was the following *(tab. 4)*:

As the table shows, it is possible to single out two obvious leaders: the fourth (difficulty in attracting financing) and the second (insufficient demand for innovation products) answers. The next three external obstacles (options 14, 6 and 5) that come close are the following:

– underdevelopment of innovation infrastructure;

– imperfect tax stimulation of innovations;

– weak prevalence of budgetary co-financing mechanisms of innovation

One can safely assert that table 3 and table 4 show the innovation specifics of not only the Murmansk Oblast, but of all the Northern regions, and, apparently, of the whole country.

The ninth question considered the possibility of the transfer of the industrial complex of the Murmansk Oblast to mainly innovation-based development. Only 43% of the specialists responded affirmatively, 25% gave negative answer, the rest were unable to choose the answer. As for the transition period, the main share of the respondents, who gave positive answer, consider the date beyond 2025 as the most likely one. In this regard, the experts noted the proportion of the produced innovation products (61%), the proportion of organizations implementing technological innovations (50%), and the number of patents granted (25%) as the main features characterizing innovation dynamics.

The opinions divided greatly on the magnitude of these signs (indicator characterizing the transition to predominantly innovation dynamics). Thus, the share of innovation organizations, experts expressed as follows *(tab. 5)*.

Assuming that this indicator made up 7.9% in the Murmansk Oblast in 2010, the majority of experts highlighted the need for a 2–3-fold increase. 80% of the respondents consider 2020 and later terms as the most probable date when such level will be achieved. More significant dynamics is required with regard to the share of the produced innovation products.

As follows from *table 6*, the distribution in the 6–9% range is rather median. Considering that in 2010 the amount was equal to 0.2%, it is expected to increase by a factor of tens, with 80% of the experts defining the date beyond 2025 as possible for achieving such rate.

Table 4. The distribution of experts opinions concerning the external obstacles to innovation activity development

№ p/p	Option	Position
1	No serious external obstacles for innovation	2
2	Insufficient demand for innovation products	16
3	The long payback period of innovation	7
4	The difficulty in attracting financing for realization of innovation projects	18
5	Weak prevalence of budgetary co-financing mechanisms of innovation	13
6	Insufficient and/or imperfect tax stimulation of innovations	14
7	Limited amount of the state procurement of innovation products	5
8	Low predictability of the industrial and innovation policy of the state	9
9	Lack of stability in the conditions of economic activity	8
10	High administrative barriers to innovation (certification, licensing, etc.)	10
11	High customs duties on imported equipment	4
12	The complexity and imperfection of customs control procedures	4
13	Introduction of new technologies will lead to the emergence (sthrengthening) of technological gap with partners on the technological chain	-
14	Underdevelopment of innovation infrastructure (industrial parks, technology transfer centres, etc.)	14

Table 5. Assessment of the proportion of innovation organizations

The proportion of organizations, %	10	15	20	25	Above 25
Distribution of answers, %	12	12	40	20	16

Table 6. Assessment of the dynamics of the proportion of produced innovation products

The proportion of innovation products, %	3	6	9	Higher than 9
Distribution of answers, %	19	33	29	19

The authors could not but comment on the expert estimates. The denoted strategic growth is possible, if the plant producing such high-tech products, as liquefied natural gas is constructed and attains projected capacity of 30–40 million tons. The formation of the Kola center of strategic materials, comprising hydrometallurgical complex for the production of concentrates of rare and rare-earth metals, could be the second element of this innovative breakthrough.

In order to identify the most important directions of the state support to innovation activities, the ranking was done based on the 4 factors, presented in *table 7*. That is, the minimum rank (place) shows the maximum value.

At this point, the authors note that the rank of science funding is somewhat overrated for the federal level. Apparently, this is due in no small part to the fact that the majority of experts are members of the academic community.

The primary sources that are most suitable and probable for obtaining funds for innovation activity, are the following:

– venture capital funds (71%),
– budget funds (61%),
– own resources of companies (57%).

Among the measures contributing to the development of innovation activity on the basis of public institutions of science and higher education, the only two directions with over 50% of the experts votes are the improvement of innovation activity financing and the professional management of innovation projects. The basic directions of stimulating the development of small innovation enterprises

Table 7. Ranking of the factors of the state support to innovations

№ p/p	Support measures	Places (ranks) at the level	
		federal	regional
1.	Increased financing of science	1.8	3.2
2.	General education improvement	3.7	1.6
3.	Improvment training of technical specialists	2.3	2.8
4.	Increased support of business, implementing scientific-technological developments	2.2	2.4

under State-run Educational Institution of science and higher school (also got the approval of more than 50% of respondents) are the improvement of the legal framework, increased interest of business in the implementation of developments, the improvement of the state support system [6].

As have been already mentioned in the beginning of the article, investment projects are the most important tool of innovation modernization of the economy. The largest of the projects under the Strategy for socio-economic development of the Murmansk Oblast up to 2025 are presented below. The respondents were asked to rate and evaluate the possible date of the first phase (stage) completion.

Table 8 shows the number of experts, who placed the investment project at the appropriate place in order of importance. The number of specialists, evaluating this or that project, does not match, as not all of them have ranked each project.

The Shtokman project is an obvious leader, and in the authors' opinion, the crucial factor here is not so much the scale of the project (according to the latest estimates total investment may exceed 80 billion US dollars), as high innovation level. Many technological solutions for aimed at the project's implementation is unrivalled in the world. Unfortunately, possible terms of the project's duration turned out to be rather pessimistic: 72% of the experts answered that 'first amount of gas' can be obtained only after 2020.

It is necessary to note that the complex development and modernization of the operating mining and processing plants is on the 2nd place, comprising not only technical upgrading of production, but also release of new kinds of innovation products, including the already mentioned components for strategic materials output.

Innovation processes in any economic system is mostly connected with the diversification of production.

Table 8. Ranking of major investment projects of the Murmansk Oblast

Project	Place (rating)									Average rank
	1	2	3	4	5	6	7	8	9	
Shtokman project (1 phase)	13	6	1	1	-	-	-	-	-	1.52
The second stage of Kola Nuclear Power Plant (5th power unit)	2	4	1	2	3	-	1	-	-	3.31
Complex development of Murmansk transport node	4	2	6	2	4	-	-	-	-	3.02
Mining and processing plant (GOK) 'Fedorovo – Tundrovskoe' (platinoids)	1	3	1	1	3	3	2	3	1	5.22
GOK CJSC 'North-Western Phosphorous Company' (apatite, nepheline)	1	4	5	5	-	3	1	-	-	3.63
GOK 'South-Eastern Gremyakha' (ilmenite-titaniferous magnetite)	-	1	-	-	2	3	4	4	1	6.58
GOK LLC 'Northern Chrome Company'	-	2	-	1	3	3	2	2	3	6.12
Complex development and modernization of the operating mining and processing plants	6	3	5	5	-	1	-	-	-	2.65
The construction of coal-run thermal power plants in the Oblast territory (Murmansk, Monchegorsk, Kovdor, etc.)	-	2	2	2	2	1	3	1	4	5.71

However, the matter of whether it would be useful to develop deep processing of mineral resources in the North (not in general, but namely in the North) has always been considered controversial. In the course of the survey 17 specialists (61% of respondents) answered affirmatively, 25% answered negatively and the rest were unable to choose the answer.

Thus, the following conclusions have been made with regard to the challenges and opportunities of innovation industrialization of the North and the Arctic zone of Russia:

• at the national level, innovation industrialization is the main landmark and tool for economic development of the Russian Federation with the view of consolidating the country's position in the fifth technological mode;

• high investment attractiveness and investment activity in the Northern and Arctic regions of the country determine the regions' opportunities and role in technical re-equipment of the country's industrial complex;

• innovation level of development of the Northern regions is characterized by high share of organisations implementing technological innovations (about 9%, while the national average is 9.4%) and relatively low share of innovation products (services) (1.5–2%, while the average made up 5%);

• weak business demand for innovation, high degree of risk and insufficient support from authorities at all levels are the main factors constraining scientific and technological progress;

• experts evaluation of the forecast indicators of the basic directions amounted to 20–25% with regard to the organizations implementing technological innovations, and 6–9% with respect to the production of innovation products and services by 2025;

• the leading factor of the long-term state support for innovation at the federal level is the increased financing of science, while at the regional level it is the improvement of the general education system. Increased support of business, implementing innovations is highlighted as important for both levels.

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