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SUBSTANTIATING THE TRANSFORMATIONS IN THE PRIORITIES OF THE INNOVATIONS AND TECHNOLOGY DEVELOPMENT OF THE RUSSIAN REGIONS AMID THE GLOBAL CRISIS¹

The purpose of this research is to substantiate the necessity for Russia to adopt a neo-industrialization policy as a tool for overcoming the consequences of the global crisis. The research hypothesis assumes that the competitiveness of Russian regions in crisis conditions cannot be enhanced without transforming the regional innovation priorities with regard to modern science and technology developments, production demands for modernization and import substitution, and accelerated the formation of the high technology sector. The authors believe that one of the main reasons for the current structural crisis in Russia is ignoring the determining impact of the innovations and technology development on the country's regional socio-economic systems as a whole. The verification of this hypothesis based on the analysis of the official statistics revealed a number of negative tendencies impeding the country in overcoming the crisis phenomena through accelerated development of modern technological paradigms: decreasing staff component and deteriorating quality of the Russian science, widening the gap between the financial support in Russia and developed countries, reducing opportunities for innovation business development, and a lack of motivation for manufacturers to engage in innovation activities. The authors substantiate the necessity to strengthen the state innovation policy for the recovery of Russia's socio-economic situation. They propose a methodological approach to choosing the priorities of innovation support for the economic development of Russian regions based on a comprehensive review of the condition and challenges in the development of research potential, the region's business environment, and its ability to master innovations. Calculations are made to assess the possibility of creating innovation activity centers in the Russian regions of various types aimed at increasing the specific weight of high-tech companies focused on the production of innovations to address import substitution and economy neo-industrialization tasks urgent for Russia. The authors developed their own methodology to evaluate the possibilities of forming various types of innovation activity centers in the Russian regions aimed at increasing the specific weight of the high-tech sector and creating domestic high-tech companies, and focused on the production of innovations to address import substitution and economy neo-industrialization tasks urgent for Russia. The article is addressed to innovation management experts.

Keywords: innovation development, technology wave, global crisis, innovation policy, innovation strategy, high technology sector, innovation business, modernization, neo-industrialization, import substitution

Introduction

It is well known that Russia possesses the world largest gas reserves and its deposits account for 10 % of the world's known oil reserves, 11 % of coal, and 26 % of iron ore². Even amid the current crisis, Russian soils annually produce 1/10 of oil, about 1/4 of natural gas, 12 % of nickel, 10 % of wolfram, a substantial part of other non-ferrous and rare metals, and 12 % of potassium salts of the total mineral resources produced by the global community. Such reserves are a dream for any country.

It is obvious that Russia will further use these resources as one of the sources of its economic development and income augmentation. Currently, federal budget receipts from mineral tax, customs duties and subsoil use fees account for over half of its revenues. The receipts from the export of mineral resources amount to over 70 % of all currency receipts. Another 11.3 % of export receipts is from the sale of metals, mineral products, and precious stones and metals.³ At the same time, it is at

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² *Mineralno-saryevyye resursy Rossii* [Mineral resources of Russia]. *Geografiya* [Geography]. Retrieved from: <http://geographyofrussia.com/mineralno-syrevye-resursy-rossii/> (date of acces: February 11, 2016).

³ *Gosudarstvennyy doklad Ministerstva prirodnkh resursov i ekologii RF «O sostoyanii i ispolzovanii mineralno-syryevykh resursov Rossiyskoy Federatsii v 2013 godu»* [State report of the Ministry of Natural Resources and Environment of the Russian Federation "On

least not cautious to count only on the resource orientation in economy. First, natural resources are exhaustible and non-renewable. The rapid reduction of readily retrievable oil resources has already become a matter of concern. Currently, 60 % of Russian reserves may, according to experts, be referred to the category of hard-to-recover reserves⁴. Second, the prices for natural resources are subject to significant fluctuations depending on the political situation and the economic environment, which has been evidenced by the oil prices for the last five years / (As compared to February 2015, the price for Brent oil dropped two-fold, and according to a number of experts, in 2016–2017, the oil prices are likely to further decrease). Finally, in view of powerful technological shifts associated with the sixth technology wave, the attempt to wriggle out of the scientific and technical progress will result in Russia's irrevocably lagging behind the developed economies and losing not only its technological, but also economic security.

Much has been written about the necessity for Russia to overcome its one-sided resource orientation [1–4]. This problem was brought forth in publications in the early 1990s at the very beginning of market reforms. At the same time, the country's economic policy still persistently focuses on its oil and gas resources as the main development resource. Oil and gas still account for some 2/3 of Russia's exports. If in the developed countries, the share of machine building and metalworking in the total production volume is about 30–50 % [5], in Russia it is only about 15–17 %, which is less than the economic security threshold being 20 %. The processing sector receives 15.6 % of the total volume of Russia's investments, including machine and equipment production having only 0.9 %. Today, Russia exports 210,000 pieces of machine tools, of them 700 pieces to far-abroad countries, and procures 845,000 pieces which is 4-fold more and of which 99 % of products are from far-abroad countries. The country exports 6,100 tractors (of which 92 % is to CIS), and imports 79,000 (13 times as many), mainly, of course, from non-CIS countries (58,300 pieces).⁵

It should also be noted that the global crisis and the economic sanctions imposed on Russia not only deteriorate Russia's technology lag, but also significantly slow down its overall socio-economic development. (According to the Ministry of Economic Development of Russia, in 2016 the GDP growth rates will only be 0.7 % y-o-y with the oil price of 50 US dollars per barrel ⁶).

In this situation, shifting to new technological paradigms is practically the only development option for Russia. Experts fairly believe that the economy that relies on resources as the main GDP source cannot be competitive and, consequently, has no future [6]. Even a halved or inertial scenario based on preserving the existing development tendencies will lead to further deterioration of the economic situation, GDP contraction, continuing decrease in the production volumes in the basic industries, and rising unemployment rates.

Crisis as an Impulse for Economic Growth and Structural Transformations

The world practice shows that even for developed countries economic growth cannot be viewed as a certain constant. The reverse side of economic growth is crisis resulting from the accumulated controversies in the production system, development and use of productive forces, and the functioning of financial, market and other institutions both in the country and globally. At the same time, as N. D. Kondratyev and his followers reasonably believed, an important condition for the progressive development of the society is its technological basis corresponding to a certain stage of its development and reflected in the availability and use by man of productive and other technologies capable of meeting the society's demands for goods and services in a more efficient way than the technologies of the previous paradigm.

A new spin in the economic development always arises on a new technological foundation. This was the case starting from the first industrial revolution, which led to the replacement of manual labor that had already exhausted its potential with machine production. In this respect, the current

the Condition and Use of the Mineral Resources of the Russian Federation in 2013"], 386. Retrieved from: <http://www.mnr.gov.ru/upload/iblock/914/Report2014.pdf> (date of access: February 23, 2016).

⁴ Timakova, N. (2008, May 14). Vne zony dostupa [Beyond access]. Kommersant Business Guide, 80. Retrieved from: <http://www.kommersant.ru/doc/889581> (date of access: February 12, 2016).

⁵ Promyshlennost Rossii. 2014: stat. sb. [Industry of Russia. 2014: Statistical book]. (2014). Rosstat. Moscow, 326.

⁶ Prognoz sotsialno-ekonomicheskogo razvitiya Rossiyskoy Federatsii na 2016 god i na planovyy period 2017 i 2018 godov [Forecast of socio-economic development of the Russian Federation for 2016 and for the planning period of 2017 and 2018]. Retrieved from: <http://economy.gov.ru/minec/about/structure/depmacro/20151026>.

structural crisis is also not an exclusion. It evidences a depletion of resources in traditional production sectors and even in microelectronics, as well as hydro carbon energy carriers, and an urgent need for structural economy transformation with a focus on technology, first of all the sixth technological paradigm (nano-electronics, artificial intelligence systems, genetic engineering, production of nano-materials, nano-biotechnology, etc.)

Hence it follows that amid a global crisis the negative consequences of which are even worse for Russia due to the ongoing economic sanctions⁷, production recession, collapse in oil prices and, as a result, a catastrophic fall of ruble, the immediate and radical reconsideration of the socio-economic development strategy and adjustment of its priorities towards neo-industrialization become of a special relevance and significance for the country.

Such adjustment is crucial not only from a political, but also from an economic perspective. According to the US National Science Foundation, the annual turnover of the nano-technology market will reach 1 trillion US dollars by 2015. By this time, the six technological paradigm will enter a phase of expansion [8]. Thus, Russia cannot miss the chance to make itself known not only as a resources and nuclear country, but also as a country with a socio-economic system based on the capabilities of modern technologies giving a new impetus to the development of manufacturing, security, education and medicine.

Import Substitution as a Preparatory Stage for Shifting to a New Technological Paradigm

In today's conditions, one of the mandatory elements of internal stability of Russia's regional socio-economic systems involves forming favorable financial, economic, and legal prerequisites for the development of new technology paradigms and increasing the country's innovation activities. Special attention today should be paid to developing an anti-crisis strategy focused on the priority development of the production sectors being the core of the new technological paradigm, substantially increasing the volume of investments into research and innovations⁸, creating an efficient system of investments and loans not for the banking (as in 2009–2011), but for real, especially high technology, economy sector, in accordance with clearly defined and legally documented priorities of socio-economic development.

Forming a new technological paradigm requires significant and targeted measures to facilitate its advancement. However, as the world practice shows, such measures rather quickly lead to efficient structural transformations in economy and economic growth. In this regard, it is worth mentioning the US' experience of forming its first research and technology parks Silicon Valley and Route 128 in the 50s of the 20th century. Their active support by the government and leading universities eventually led to the creation of the largest and world-famous microelectronics centers in far-from-prosperity regions [9]. Similar processes in the 80s of the 20th century took place in other countries, including Japan that with active support from the Ministry of Industry and Trade developed Technopolis, its famous program under which new production facilities were created in over 20 prefectures based on the technologies of the fifth technological paradigm, that turned the country into a powerful "high technology archipelago" [10 P. 51], and asserted itself as a world-class manufacturer of modern cars, domestic electronic equipment, robotics, and mobile devices.

Russia's longstanding resource orientation has a powerful inertial effect that will have a strong opposition pressure on the state institutions that make strategic decisions. However, with the present rigorous foreign policy and in view of the critical condition in the Russian economy, any procrastination with neoindustrialization in Russia will only worsen its economic situation and lead to increased social tension.

Import substitution could become an important tool to accelerate the formation of the new sixth technological paradigm in the Russian economy. It's not a secret that Russian economy today largely depends on import. For the last decades, Russia exports mostly raw products (where oil and gas account for 2/3 of exports), and imports machines, equipment cars, medicines, foodstuffs. Import substitution

⁷ According to the Accounts Chamber of the Russian Federation, the total costs for overcoming the economic crisis, including the funds spend to support ruble, amounted to some 16 trillion rubles or 40 % of GDP. Russia experiences the highest GDP drop both among oil exporting countries, and among the Group of Twenty, and the highest level of inflation (according to [3]).

⁸ According to S. Glazyev, for Russia to adopt a new technological paradigm its costs for health care and education, being the key supporting industries of the new technological paradigm, should be increased at least 1.5-fold and its allocations for science should two times as many.

is generally considered as a type of the country's economic strategy and industrial policy focused on the protection of domestic manufacturers by making domestic products similar to imported ones. However, Import substitution should not be understood solely as a substitution of any import products regardless of their quality and novelty. Today, import substitution is crucial for Russia not only as a measure to protect domestic manufacturers, but also as a new stimulus for the development of its economy, a preparation for its transition to the new technological paradigm.

As a matter of fact, import substitution should be considered as one of the neoindustrialization areas that implies developing a knowledge-based economy, efficient use of human resources, communication, computer and other new technologies. Thus, only efficient use of modern technologies will allow the Russian economy to shift to a new development model that will help it to substantially enhance the quality of life. According to the forecasts of the Ministry of Industry and Trade of Russia, in the case of implementing a well-thought-out import substitution policy, by 2020 we can expect a decrease in import dependence in various industries from 70–90 % to 50–60 %, and in a number of industries, even lower indicators are possible.

The survey conducted by the Ministry of Industry and Trade of the Russian Federation in June 2014 showed that the most prospective industries in terms of import substitution include machine tool building (the share of import in consumption is over 90 % according to various estimates), heavy machine building (60–80 %), consumer goods manufacturing (70–90 %), electronic industry (80–90 %), pharmaceutical and health care industry (70–80 %), as well as machine building for food industry (60–80 %).⁹

Import substitution is of special relevance for old industrial regions, the economic development of which is based on manufacturing industries, first of all, machine building. In old industrial regions, the potential for import substitution is represented by qualified personnel and prospective scientific developments. Moreover, they have a long-felt need for the modernization of basic industrial complexes. Thus, these regions are the most suitable springboard for restoring the manufacturing industry of Russia and reducing its dependence on the economy of foreign manufacturers, including for the most critical production group for the manufacture of production tools. In the Ural Federal District, such regions include the mining zone of the Sverdlovsk and Chelyabinsk Oblasts, as well as several settlements of the Kurgan Oblast.

By the development level of the high technology production sector, the Sverdlovsk Oblast is ranked the 8th and the Chelyabinsk Oblast is ranked the 11th among the federal subjects of Russia. Both Oblasts have high capabilities for the development of metallurgy, which is a rather powerful potential consumer of import-substituting industrial products, on the one hand, and a supplier of a variety of metallurgical products of various quality for the machine and tool building industry, on the other hand (Table 1). The oil-producing regions of the Tyumen North can be viewed as a large market outlet for import-substituting industrial equipment and household goods.

The index used in Table 1 to indicate the development level of production sectors with various technology intensiveness in Russian regions is formed by the authors with regard to the information provided in Rosstat's official statistical books. It is calculated based on the data about the production volumes in the applicable production sectors, as well as the quantity and structure of involved labor forces in Russia's subjects. The proposed index seems rather convenient to analyze the spatial location of the country's production potential with regard to its structure, and to provide an objective assessment of strong and weak points of individual regions as the players on the Russian industrial products market in key segments.

The Chelyabinsk and especially the Sverdlovsk Oblasts are characterized by their developed logistics and a rather high level of energy security. It should also be taken into account that they preserved a number of large heavy and medium machine building companies, defense and nuclear organizations, fine chemistry and pharmaceutical companies, or in other words, these regions have the traditions, experience and skills of production activities focused on the manufacture of high science-intensive and technically complex products. In relatively good years between the defaults of 1998 and 2014–2015, most of the currently operating companies could to a certain extent modernize their basic production assets. The old industrial regions of the Ural Federal District have a rather decent,

⁹ Importozameshchenie: pervyye shagi [Import substitution: First steps]. *Biznes Rossii* [Business of Russia]. Retrieved from: <http://businessofrussia.com/dec-2014/item/968-first-steps.html> (date of access: May 15, 2015).

by Russian standards, research, technical, and innovation potential, which is another key strength of these territories as a production platform of import-substituting innovation products.

Table 1

Ranking of the Ural Federal District Regions by the Development Level of Industrial Production Facilities of Various Technology Intensiveness (as of 2014)¹⁰

UFD region	Region's development level of production facilities with various technology intensiveness					
	high technology-intensive production facilities		metallurgy and metal working (medium technology-intensive production facilities of a low level)		resource producing sectors (low technology-intensive complex)	
	index value	ranking among the Russian subjects	index value	ranking among the Russian subjects	index value	ranking among the Russian subjects
Kurgan Oblast	0.08	52	0.06	47	0.00	68
Sverdlovsk Oblast	0.41	8	0.92	1	0.07	14
Tyumen Oblast	0.12	38	0.09	36	1.00	1
including: Khanty-Mansi Autonomous Okrug — Yugra	0.06	61	0.02	65	0.67	2
Yamalo-Nenets Autonomous Okrug	0.02	70	0.01	75	0.29	4
Chelyabinsk Oblast	0.31	11	0.78	2	0.04	23

By the quantity of labor forces involved in R&D, the Sverdlovsk Oblast is the 6th in Russia, and the Chelyabinsk Oblast is ranked the 7th; and by the volume of manufactured innovation products, they are ranked the 10th and the 14th respectively. At the same time, it should be noted that the positions of the Sverdlovsk Oblast as a participant of the innovation activities have for the recent global economic crisis become substantially weaker: in 2006, it ranked the 4th among Russian regions by the volume of innovation products per 10,000 persons involved in economics, while in 2014 it was already the 15th on that list. And while the Chelyabinsk Oblast managed to preserve its average annual increase in the manufacture of innovation products at 3.7 %, the Sverdlovsk Oblast demonstrated a noticeable drop in the manufacture of products with the signs of scientific and technical novelty (annually by 11 % on average)¹¹.

The authors conducted a survey among the heads of academic institutions, which revealed that the region has scientific reserves and staff potential to promote innovation businesses that would manufacture competitive products as compared to foreign analogues in a number of prospective areas and create brand new products and technologies. Every year, the Urals academic institutions develop over 50 technologies that could be used in economy (for example for the search, extraction, and processing of ore resources, casting and rolling of metals, production of new structure materials, chemical productions, pharmacologically active substances, modern communication means, waste processing, etc.) The institutions of the Ural Branch of RAS have over 400 legally documented intellectual property items, the two-thirds of which are brand new and almost half of which have no foreign analogs, including unique developments for such critical technologies as nano-technologies and nano-materials, cell technologies, bioengineering technologies, genome technologies, composite and ceramic material production and processing technologies, basic industrial technologies, etc.

A substantial part of these developments is practically ready for implementation. But most of them remain unclaimed by the industry largely because of prevailing monopolism, corruption, lack of an efficient system for protecting private entrepreneurship and other manifestations of the climate uncongenial for science and innovations. Today, Russia's economy uses maximum 3–5 % of domestic

¹⁰ Regiony Rossii. Sotsialno-ekonomicheskie pokazateli. 2014: stat. sb. [Russian regions. Socio-economic indicators. 2014: Statistical book]. (2015). Rosstat. Moscow.

¹¹ Regiony Rossii. Sotsialno-ekonomicheskie pokazateli. 2014: stat. sb. [Russian regions. Socio-economic indicators. 2014: Statistical book]. (2015). Rosstat. Moscow.

research developments, and the level of innovation activities of the companies operating in the Sverdlovsk and Chelyabinsk Oblasts is only 11.0 and 8.5 % respectively¹².

It should also be noted that forming modern production clusters focused on import substitution in the old industrial regions is of crucial significance not only for the country's re-industrialization, but also for preventing further degradation of labor relations. According to our estimates based on the Rosstat data, even compared to 2006, the number of those involved in the manufacturing sector of Russia's industry have by now reduced almost by 20 %, including in the production of machinery and equipment (one of the activities with the highest demands for the qualification of production personnel) — practically by 1/3. It is in the country's interests to create proper conditions for people with a professional qualification, skills, and work experience not to reorient themselves and not to encourage their children to choose low-skilled jobs as their primary earnings.

The above factors allow us to view the old industrial regions of the Ural Federal District as a wide polygon for the creation of production clusters for the manufacture of import-substituting products in prospective areas.

Innovation Possibilities as the Key Resource of the Import Substitution Strategy in the Old Industrial Regions

Currently, import substitution started in a number of regions, including the Sverdlovsk Oblast. Among the region's priority import substitution areas are the products for the needs of the military and defense complex, pharmaceutical production development, and strengthening of food safety. However, this process is now spontaneous, and there is no scientifically substantiated strategy of its implementation. Of course, the problem of import substitution is very complicated and cost intensive. Analysts estimate the costs required to address this problem to be minimum 17.6 trillion rubles. That was the amount of annual import in 2014.¹³ At the same time, delays in addressing this problem are not only dead-end, but also dangerous for the stagnating Russian economy that significantly lags behind developed economies in terms of technologies. The issue of choosing scientifically sound import substitution priorities is of special relevance today in the context of forming the import substitution strategy of the Russian Federation and its regions.

It should be noted that the import substitution policy has to a certain extent been implemented in Russia in individual economy branches for 25 years already. But it is mostly concentrated on a narrow spectrum of areas related to state security, including technological independence of the country's defense, nuclear, and space complexes. Thus, in some sectors of the Russian defense industry the share of imported accessories today is about only 7–12 %, and in a number of sectors of the military-industrial complex this problem is already settled [11]. On January 1, 2014, in order to activate the processes of import substitution in the defense complex the Russian Government order under No. 1224 d/d December 24, 2013, "On Imposing a Ban and Restrictions on the Admission of Goods Originating in Foreign Countries and Work (Services) Provided by Foreign Persons for the Procurement of Goods and Work (Services) for the Country's Defense and Security" was put in effect. According to these documents, everything related to the country's defense and security must be produced in Russia. In this regard, Russia declared a large-scale program for the re-equipment of its military-industrial complex. In 2015, the Russian budget costs on national defense grew by over 30 % and amounted to over 3 trillion rubles¹⁴.

At the same time, it should be mentioned that the declared import substitution policy, that could become the core of the current industrial policy, is for now obviously inconsistent [12]. The Russian law No. 488-FZ d/d December 31, 2014, "On the Industrial Policy in the Russian Federation" that took effect on July 1, 2015, does not even use the term "import substitution". However, the Russian production sphere cannot recover without addressing the issues related to the restoration of its own machine building based on modern technologies and the development of the civil sector of the high-tech industry capable of competing with foreign manufacturers both in price and in quality. Especially

¹² Regiony Rossii. Sotsialno-ekonomicheskie pokazateli. 2014: stat. sb. [Russian regions. Socio-economic indicators. 2014: Statistical book]. (2015). Rosstat. Moscow, 731.

¹³ Kravchenko, L.I. (2015, March 20). Import substitution. Price and time period [Importozameshchenie. Tsena i sroki]. Nezavisimaya gazeta [Independent newspaper].

¹⁴ Importozamshchenie. Pervyye shagi. [Import substitution. First steps]. Biznes Rossii [Business of Russia]. Retrieved from: <http://businessofrussia.com/dec-2014/item/968-first-steps.html> (date of access: May 15, 2015).

that Russia, in particular, its old industrial part, still has a potential for research and innovations to substitute import and to be used for economic recovery.

Specifying the Priorities of Innovation Development in the Russian Regions During the Crisis

The concept of long-term sustainable development involves establishing import substitution priorities in a broad socio-economic context. In other words, along with increasing the technological independence of the country and economy competitiveness of its individual regions, the priorities must be established with regard to the efforts for strengthening the grounds of the territory's sustainable development and the pre-requisites for improving the quality of its human capital. Thus, establishing import substitution priorities is to a large extent associated with forecasting the region's future.

It is the reason why developed countries take special efforts to create conditions for preserving their own research potential and for prompt translation of obtained knowledge into innovations as the basis of their technology independence and a strategic springboard for winning and retaining leadership in the global technology markets.

In view of the foregoing, the key criteria for establishing the priorities of the import substitution strategy for the old industrial regions should include:

- 1) compliance of the proposed projects with advanced fields of the scientific-technical progress;
- 2) focus on enhancing the country's technical and technological economy security in key areas (creation of modern machine tools and equipment, weaponry, transport and communications, medical equipment, pharmaceuticals, etc.);
- 3) the need for technology modernization and restructuring of the production complex, as well as the creation of high and medium technology-intensive processing facilities to ensure the region's competitiveness;
- 4) contributing to the preservation and development of the region's scientific-technical potential, improving the efficiency of using the territory's innovation capabilities for its socio-economic development;
- 5) importance for the solution of the territory's social problems (employment, higher income and education, health care, etc.), ensuring resource and ecological security of its development;
- 6) availability of investments, staff and other resources in the region for the implementation of import substitution in specific areas.

At the same time, in practice the Russian government is rather spontaneous in selecting its support priorities in view of the remaining Soviet era centers with rather high, by Russian standards, research and (or) innovation activity and lobbying [8]. Apart from failing to be advantageous, this approach, especially in a crisis, threatens with the accelerated decay of innovative R&D potential beyond "privileged" regions. Thus, while R&D personnel in Moscow decreased by 13.5 % for 2000–2013 (which is alarming per se), Sverdlovsk Oblast experienced almost a 1/4 drop, Yaroslavl Oblast — 1/3, Samara Oblast — 1/2, and Kemerovo Oblast — 2/3 (authors' calculations).

Having analyzed the regularities, specifics, and contradictions of the innovation and technology component in the development of regional socio-economic systems, the authors have formulated a methodological approach and developed an original methodology that can be used to set reasonable priorities in the innovation development of the Russian regions with regard to their research and innovation potential, and the specifics determined by their production technology type. The priorities of increasing the innovation competitiveness of the regions were substantiated taking into account not only their accumulated R&D and innovation potential, but also the specific interaction and interdependence of their innovation and socio-economic development.

In developing the priorities, the authors also considered the cardinal changes in the condition and prospects of Russia's R&D potential, and the transformations in its territorial location with regard to the possibility of creating new technology development centers in the regions.

In view of the fundamental differences in the nature of innovation activity of the Russian regions of different industrial and technological types, the quality of their accumulated R&D potentials and regional economic needs for innovations of various complexity and novelty, the selection of territorial priorities under the country's innovation policy appears to require that the consolidated indicators describing the achieved innovation activity level be considered in conjunction with the data that shed light on the industrial and technological types of the regions and the development level of their

production facilities that are essential for ensuring sustainable economic development of Russia in the long run.

The authors offer a somewhat modified innovation activity index to assess the territory's capability for innovations. It is based on sub-indices of research and development and innovation activity, innovation infrastructure and innovation-friendly environment as a factor of economic growth. The structure of the indices is based on the globally accepted methodological approaches to forming competitiveness and innovation indices¹⁵.

Thus, the R&D index is based on Rosstat's data on R&D employees, expenses on R&D, and patenting activity of the regions; the innovation index is based upon the data on the expenses on innovations, production of innovative goods, and use of new technologies. For more details about the structure of these indices, see [13]. The index of innovation-friendly environment as a factor of economic growth is based on the indicators describing the development level of the region's processing industry, including hi-tech sector (by the number of employees and production volumes), and the development of its higher education system.

The resulting index is calculated as a weighted average. The weighted coefficients of all sub-indices are taken as 1, except for the innovation infrastructure sub-index taken with the coefficient of 0.2. This is due to insufficient reliability and incomplete information about the condition of the innovation structure, and the low performance of these objects [14].

To assess the development level of the regions production facilities having various research intensiveness, the authors offer the respective indices calculated based on the data about the number and structure of labor forces engaged in production by the production types in the subjects of the Russian Federation using the same formula as for the innovation activity index. It should be noted that the current Russian statistics provide a somewhat distorted picture of the real production structure due to the prevailing system of reporting by vertically integrated structures based on economic performance at the place of registration of the company's head offices (usually Moscow, St. Petersburg, and a number of other megalopolises). However, in view of the specifics of Russian monopolies as the subjects of innovation activities, and the above-mentioned reality of the country's R&D sector, it will rather contribute to a better choice of proper places for the location of innovation centers intended to maintain the monopolized types of activities. If the situation with the monopolization of the Russian economy changes, it will have an immediate effect on the statistics of the region's real production and technology type and will signal the need for changing the spatial architecture of the innovation support for the production processes.

The integrated priority index for the formation of innovation activity centers to support the production facilities of various technology intensiveness should be calculated as the arithmetic average of normalized values of the innovation activity index (that takes into account the level of science and innovations development, as was already mentioned, and the condition of the region's higher education as a key characteristic feature of its capability to provide high-skilled work force) and the development index of production facilities with various technology intensiveness. Given the precision of present-day statistics, it seems premature to introduce weighted coefficients to the resulting formula.

The final decision on selecting the priority territories to form innovation activity centers should be made with regard to the possibilities of developing a civil science and innovations sector in the region, in particular real distribution of science labor forces among civil and defense sectors, the structure of effective demand for innovation deliverables by the degree of their novelty and technical complexity, possibility to reach consumers beyond the region, as well as Russia's long-term geopolitical interests, etc.

In view of the critical condition of Russia's research sector, the measures for creating innovation centers must not be limited to the support of innovations, but provide for the rehabilitation of the science sphere as the basis for innovation processes.

Table 2 provides the calculated priority index for the formation of innovation activity centers intended to support the development of high and medium technology-intensive production facilities of a high level for the Top 10 Russian constituent subjects.

¹⁵ See: The Global Competitiveness Report. 2014–2015. (2014). World Economic Forum. Geneva, Switzerland, 565; Innovation Union Scoreboard. 2013. (2013). European Union, Belgium, 80.

The strategic objective of these centers is to build an engineering and technological platform for the development of domestic high technology-intensive production facilities and to expand the Russian segment in the market of high technology-intensive goods and services.

Table 2

RF Constituent Subjects Rated by the Priority of Forming the Elements of the Innovation System that Ensure the Development of High and Medium Technology-Intensive Production Facilities of a High Level (as of 2014)¹⁶

Constituent subject of the Russian Federation	Priority of forming innovation centers intended to support the development of high and medium technology-intensive production facilities of a high level		Development index of high and medium technology-intensive production facilities of a high level		Innovation activity index	
	Index value	Rank in Russia	Index value	Rank in Russia	Index value	Rank in Russia
Moscow	1.00	1	1.00	1	1.00	1
St. Petersburg	0.83	2	0.81	2	0.85	2
Moscow Oblast	0.76	3	0.76	3	0.75	3
Republic of Tatarstan	0.60	4	0.64	5	0.56	5
Samara Oblast	0.59	5	0.67	4	0.51	6
Nizhny Novgorod Oblast	0.54	6	0.49	6	0.60	4
Sverdlovsk Oblast	0.46	7	0.47	8	0.44	10
Perm Krai	0.45	8	0.47	7	0.42	11
Kaluga Oblast	0.44	9	0.38	9	0.50	7
Chelyabinsk Oblast	0.36	10	0.35	11	0.36	12

The regions listed in Table 2 are old science and technology centers with a rather large share of high technology-intensive production facilities in the structure of their economy. However, in the Chelyabinsk Oblast, for example, the substantial share of its R&D and innovation potential is concentrated in restricted-access administrative facilities and military-industrial complexes, which substantially reduces the real prospects of creating civil high-technology centers here that would be competitive in the world market. In the Perm Krai, there is another serious impediment for the creation of high-technology innovation centers. Currently, the region's dominating paying consumer is the oil and gas industry, and innovation companies will at least in the mid-term generally focus on this buyer (and this is mostly medium and low-level innovations). And the opportunities to reach foreign consumers are much fewer for the innovators in this region as compared to those in the central and near-border subjects of the Russian Federation.

When making a final decision on selecting the territories for the formation of innovation activity centers intended to produce breakthrough civil-purpose innovations, it is expedient to more thoroughly evaluate the potential of the regions that preserved natural science and technical institutions of the Russian Academy of Sciences and have experience in organizing innovation enterprises. They include the Novosibirsk and Tomsk Oblasts rated the 16th and 9th among the Russian regions by the innovation activity index, and ranked the 8th and 4th by the level of their R&D activities, respectively. However, in view of their production structure, which is unfavorable for innovation activities, these territories have an urgent need for state organizational support so that the innovators could reach potential consumers beyond the region as a survival condition for local research-intensive businesses.

Table 3 contains calculations for the territories of priority location of innovation centers for the support of competitive medium technology-intensive production facilities of a low level, by the example of metallurgy. These innovations are extremely important to reduce the technological dependence of these groups from foreign suppliers of equipment, technologies, and engineering services. The location priorities for the innovation centers of this group are largely affected by the high monopolization of production facilities with low mineral resource limits in Russia. This explains why Moscow, Moscow

¹⁶ Regiony Rossii. Sotsialno-ekonomicheskie pokazateli. 2014: stat. sb. [Russian regions. Socio-economic indicators. 2014: Statistical book]. (2015). Rosstat. Moscow.

Oblast and St. Petersburg have leading positions in the rating. At the same time, as it was already mentioned, the location of the head innovation centers that support these production facilities in the central regions of the country is quite expedient regarding the sector's existing ownership and management structure.

Table 3

RF Constituent Subjects Rated by the Priority of Forming the Elements of the Innovation System that Ensure the Development of High and Medium Technology-Intensive Production Facilities of a High Level (2014)

Region	Priority of forming innovation centers intended to support the development of medium technology-intensive production facilities of a low level (by the example of metallurgy)		The development index of medium technology-intensive production facilities of a low level (by the example of metallurgy)		Innovation activity index	
	Index value	Rank in Russia	Index value	Rank in Russia	Index value	Rank in Russia
Sverdlovsk Oblast	0.77	1	1.00	1	0.44	10
Moscow	0.65	2	0.41	5	1.00	1
Chelyabinsk Oblast	0.64	3	0.84	2	0.36	12
Moscow Oblast	0.58	4	0.47	4	0.75	3
St. Petersburg	0.53	5	0.31	9	0.85	2
Krasnoyarsk Krai	0.51	6	0.65	3	0.32	16
Nizhny Novgorod Oblast	0.44	7	0.34	8	0.60	4
Republic of Tatarstan	0.36	8	0.23	13	0.56	5
Samara Oblast	0.35	9	0.25	11	0.51	6
Lipetsk Oblast	0.32	10	0.39	6	0.22	31

The proposed methodological approach enhances the expedience of selecting spatial and most preferable priorities of strengthening the innovation competitiveness of the Russian Federation with regard to the need for ensuring socio-economic resistance of the regions, and subject to the specifics of science and innovation potential and demands for the innovation support of production activities in specific territories. The obtained formalized assessments of the priority of creating innovation centers in the Russian regions may be used as an information base for making decisions in forming the innovation policy of Russia.

Conclusion

The analysis demonstrates an urgent need, without any alternatives, for an accelerated neo-industrialization of Russia's economy with an intensive introduction of the sixth-paradigm technologies, which will provide the preconditions for overcoming its technology lag behind developed countries and for stabilizing its economy. The long-standing global structural crisis, including the drop in production volumes, ecological catastrophe, fall of oil prices, and serious dysfunctions of financial and economic institutions that have to a certain extent affected practically any country, evidence that such resources as hydrocarbons, or the technologies of the previous technology paradigms are no longer sufficient for the development of modern socio-economic systems. Russia's inertial development based mostly on mineral resources has no prospects and is sure to lead to irremediable breakdowns and failures in economy, national security, and social life.

Developing and implementing a state import substitution strategy, that would involve mobilization of resources for the promotion of innovations and the creation of "growth points" in the form of production facilities intended to substitute foreign goods with competitive domestic products, may become an important stage and mechanism of neo-industrialization in Russia.

Successful implementation of import substitution tasks requires a selective state policy built with regard to the specifics of production and innovation potentials of specific regions, their demands and capabilities in economy rehabilitation. Such approach offered in this article provides real grounds for utilizing the capabilities of the import substitution policy to strengthen the regions internal

development sources amid socio-economic instability and to stimulate the process of economy neo-industrialization.

The methodological approach offered by the authors makes it possible to select the optimum areas in the current conditions for transforming the priorities of the innovation and technology development of the Russian regions in order to accelerate the modernization of Russia's production complex and to strengthen its competitiveness in the long term.

The obtained formalized assessments of the priority of creating innovation centers of various specialization in the Russian regions may be used as a tool base in forming and adjusting the state regional innovation policy.

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References

1. Lvov, D. S. (1990). *Effektivnoye upravlenie tekhnicheskim razvitiem* [Efficient management of technical development]. Moscow: Ekonomika Publ., 176.
2. Abalkin, L. I. (1994). Ekonomicheskaya bezopasnost Rossii: ugrozy i ikh otrazhenie [Economic security of Russia: threats and their counteraction]. *Voprosy ekonomiki* [Questions of economy], 12, 4–13.
3. Glazyev, S. Yu. *O strategii modernizatsii i razvitiya ekonomiki Rossii v usloviyakh globalnoy depressii* [On the strategy of modernization and development of the Russian economy amid global depression]. Retrieved from: http://www.glazev.ru/econom_polit/269/ (date of access: 04.03.2016).
4. Yakovets, Yu. V. (2004). *Epokhalnyye innovatsii XXI veka* [Epochal innovations of the 21st century]. Moscow: Ekonomika Publ., 439.
5. Grinberg, R. S. (2010). Osushchestvima li rossiyskaya modernizatsiya? [Could the Russian modernization come true? *Zhurnal Novoy ekonomicheskoy assotsiatsii* [Journal of the new economic association], 1, 143–146.
6. Polovinkin, V. N. & Fomichev, A. B. (2014). Problemy importozameshcheniya v otechestvennoy ekonomike [Problems of import substitution in national economy]. *Ekspertnyy soyuz* [Expert alliance], 12, 30–33.
7. Kondratyev, N. D. & Oparin, D. I. (1928). *Bolshie tsikly konyunktury. Doklady i ikh obsuzhdenie v Institute ekonomiki. 1-e izd.* [Major business environment cycles. Reports and their discussion at the institute of economics. Edition 1]. Moscow, 287.
8. Glazyev, S. Yu. & Kharitonova, V. V. (Eds). *Nanotekhnologii kak klyuchevoy faktor novogo tekhnologicheskogo uklada v ekonomike* [Nanotechnology as the key factor of the new technological paradigm in economy]. Moscow: Trovant Publ., 246.
9. Mackun, P. *Silicon Valley and Route 128: Two Faces of the American Technopolis*. Retrieved from: http://www.netvalley.com/silicon_valley/Silicon_Valley_and_Route_128.html (date of access: 20.02.2016).
10. Masser, J. (1991). Technology and regional development policy: A review of Japans Technopolis Programm. *Regional Studies*. Cambridge, 24(1), 42–53.
11. Danilov-Danilyan, A. (2015, February 24). *Importozameshchenie v Rossii-2015. Chem obrnetsya krizisnaya politika dlya kompaniy* [Import substitution in Russia-2015: What will the crisis turn out for companies]. Kommercheskiy direktor [Commercial director]. Retrieved from: <http://www.kom-dir.ru/article/309-importozameshchenie-v-rossii-2015> (date of access: 15.02.2016).
12. Romanova, O. A. (2012). Neoindustrializatsiya kak faktor povysheniya ekonomicheskoy bezopasnosti staropromyshlennykh regionov [Neoindustrialization as a factor of increased economic security of old industrial regions]. *Ekonomika regiona* [Economy of region], 2, 70–80.
13. Golova, I. M. (2013). Metodologicheskie problemy obosnovaniya regionalnykh prioritetov innovatsionnogo razvitiya [Methodological problems of substantiating the regional priorities of innovation development]. *Ekonomika regiona* [Economy of region], 2, 145–156.
14. Golova, I. M. & Suhovey, A. F. (2015). Innovation and Technological Development of Industrial Regions under Social and Economic Insecurity. *R-Economy*, 1, 98–108.

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