The development of the Russian economy under the influence of the Fourth Industrial Revolution and the use of the potential of the Arctic

Tatiana Kharlamov*a, Andrey Kharlamovb and Rossiniya Gavrilovb

1 Peter the Great St. Petersburg Polytechnic University, Politekhnichestkaya st., 29, St. Petersburg, 195251, Russia
2 St. Petersburg State University of Economics, Sadovaya st., 21, St. Petersburg, 191023, Russia

*a E-mail: Kharlamova_t@list.ru

Abstract. The article discusses the influence of the Fourth Industrial Revolution on the global and Russian economies through the changes occurring in the global energy market and the opportunities that open up in the development of the natural resources of the Arctic. As part of this, the trends introduced by new technological capabilities and global warming with their impact on the industrial development of the Arctic zone are identified and investigated. Of particular interest is associated with the extraction of natural gas and its delivery to consumers using the advantages of the Northern Sea Route. According to the authors, the expected increase in demand for energy, especially liquefied natural gas (LNG), is a consequence of the Fourth Industrial Revolution, which requires adequate action on the part of its suppliers. The authors indicate that strengthening Russian positions in the LNG market makes it possible to increase the stability of this global market. This meets the interests of all of its key actors, especially the countries that form the largest demand for this product. The article concludes that, along with increasing Russia's global competitiveness, this will ensure the sustainability of the world market against the background of the advantages that the Fourth Industrial Revolution brings.

1. Introduction

An analysis of globalization, and the processes that it generates in the field of economy and national security, indicates the need to search for new sources of economic development, as a key basis for the welfare of the state and all its citizens. A large number of various factors influence the development process: economic, political, natural, environmental and others. Despite the fact that economic factors are only one of the elements of this set of factors, they are the basis for the solving of the central task of ensuring the economic development of the state. There is no doubt that the most of the issues in the field of ecology, national security, and much more is determined by the presence of economic opportunities that a country has. From this point of view, enormous scientific and practical interest is associated with the study of the potential of the Arctic as a region with a large reserve of natural resources and a promising area of international cooperation.

Realization of the existing potential of the Arctic zone should base on new industrial and technological opportunities, determined by the modern period of development of the global economy. It is associated with the emergence of new trends that correspond to rapid technological changes and
digitalization of all spheres of the socio-economic space in the framework of the growing Fourth Industrial Revolution.

2. Methods
The Fourth Industrial Revolution should bring a new quality of life to humanity, which implies a significant increase in the share of the innovative, information-oriented services, including due to the high level of robotics. In this regard, both quantitative and qualitative development will continue not only in the service sector, but also in industry, as well as state regulation [1]. In particular, the same robots that will actively use in the service sector require a significant change in the production sector, and not only in the field of robotics, but also in the basic industries, which also involves their robotization. This, in turn, requires an increase in the introduction of additional production factors into economic circulation.

Today we are witnessing a downward trend in the use of working hands (labor as a factor of production) along with a growth in consumption of various energy, primarily electricity, as well as mineral resources. The mining and processing of minerals are transferring to a qualitatively new level, which will provide the efficiency of their use and reduce environmental pollution. The task for today is to increase the volume of production in accordance with the volume and structure of demand for minerals and energy resources [2]. This means that the role of technologies developed thanks to the achievements of the Fourth Industrial Revolution will constantly increase.

If we consider only natural gas and oil from the entire spectrum of minerals and energy resources, then, based on existing estimates, we can expect an increase in demand by 2035: for gas - by 35-40%, for oil - by 10-15% [3].

In this regard, the growing processes of the Fourth Industrial Revolution require the solution of the following important tasks:
1. Increasing the depth of processing of energy resources and reducing the burden on the ecosystem caused by pollution of the territories;
2. Introduction into production turnover of new territories rich in energy resources and other minerals;
3. The search for new types of energy resources and an increase in the share of alternative energy sources used.

From the point of view of our study, among the indicated tasks, the second task, connected with the introduction of new territories into the economic turnover, is of greatest interest [4]. If we talk about Russia, then the most promising for our country in this context is the territory of the Arctic, due to the availability of mineral resources that it possesses.

As we know, the Arctic has divided into five sectors of responsibility between the following states - Denmark, Canada, Norway, Russia and the USA. At the same time, the exact border of the Arctic hasn’t yet been determined, but its status is enshrined in international agreements [5]. It should be noted that existing geopolitical interests influence the nature of the generation and implementation of agreements by these and some other countries, as well as the change in the nature of economic and other activities in the Arctic region [6, 7].

The explored natural reserves of this region can be described as a strategically important factor determining the sources of supply to the world market of minerals and energy resources necessary for industry in the epoch of the Fourth Industrial Revolution [8, 9]. In the Arctic, there are deposits of gold, platinum, nickel, copper, iron and, of course, oil and natural gas. In addition, about 25% of the world's fish stocks are located here [10].

If we analyze only the energy resources of the Arctic, we can see their distribution among the countries that have their own areas of responsibility in this region (table 1).

| Country     | Natural gas | Oil |
|-------------|-------------|-----|

Table 1. Distribution by countries of proven hydrocarbon reserves in the Arctic region, % (current estimates) [11]
The territory under consideration characterizes by a significant difficulty in the exploration, production and delivery of the obtained resources to the final consumer, which is due to the climatic conditions and the significant territorial remoteness of the Arctic from the main consumers. Overcoming existing obstacles is possible only through the development and implementation of new technologies, including those that can significantly reduce the presence of people in these areas, while increasing the share of robotics working in extremely difficult conditions (at very low temperatures) [12]. This process involves the development and diversification of means of transportation for the delivery of the extracted energy resources. The ongoing process of global warming has a certain positive circumstance (note that, in general, global warming nonetheless has a negative effect on the planet and human economic activity).

Based on this, national governments as well as large national and international companies should use the additional opportunities that arise in connection with global warming in the development of the Arctic zone [13]. There are two important directions:

1. Such consequence of warming as the process of reducing the area and thickness of ice, positively affects navigation by simplifying it and increasing its time duration [14].
2. Facilitating access to energy deposits is a sort of technological simplification of their development. At the same time, the interest in the region of potential competitors from other countries is growing. It contributes to the emergence of not only economic, but also other types of confrontation. This situation has already observed today and requires additional measures from governments to protect national economic and other interests.

It follows that the Fourth Industrial Revolution, along with global warming, can significantly increase access to the extraction of natural resources in the Arctic. However, the strategic priorities of Russia associated with the development of the natural resources of the Arctic come into conflict with the need to reduce the share of energy dependence of its national economy and the transition to the production of final high-tech goods with a high share of added value [15].

Our study showed that softening of this contradiction should be associated with a significant increase in the volume of technologies and innovative equipment used to develop the Arctic region, manufactured in Russia. This affects not only the sphere of developing new and improving existing technologies and industries based on robotics and the use of critical macro-technologies [16], but also the managerial sphere. In this regard, it is necessary for our country to implement a number of actions grouped in the following areas:

- forecasting the global dynamics of supply and demand for energy resources and the influence exerted on this process by geopolitics;
- development of new technologies and the formation of an effective mechanism for their implementation in the process of extraction and supply of energy resources in the conditions of low temperatures;
- analysis of all types of risks in the field of energy resources production and development of management decisions to eliminate risks or minimize their influence;
- protecting national economic and geopolitical interests in the Arctic region in the context of increased competition from various countries for the share of conducting economic activities in this region;

|                | 70  | 41 |
|----------------|-----|----|
| Russian Federation | 70  | 41 |
| USA             | 14  | 28 |
| Denmark         | 8   | 18 |
| Canada          | 4   | 9  |
| Norway          | 4   | 4  |
| **Total**       | 100 | 100|
• creation projects for the development of new deposits of minerals, taking into account the reduction of the negative burden on the ecosystem of the Arctic and our planet as a whole, etc.

The specified list of actions is not exhaustive; however, it sets the guidelines for using the capabilities of the Fourth Industrial Revolution for the development of both domestic industry and the Russian economy as a whole.

Based on the purpose of this study, defined as indicating the new sources of economic development of our country using the potential of the Arctic region, it is necessary to determine the main scientific method for its achievement. The authors propose to use the modeling of the spatial organization of a regional economy as such a method. This will allow us to determine from the modern scientific positions the characteristics of the economic system localized in space (in a certain territory), in which the Arctic region will act. In the context of the Fourth Industrial Revolution, the specialization of this territory and its place in the economic system of the Russian economy will model.

3. Results and Discussion

When modelling a complex of recommendations for the development of the natural resources of the Arctic, it bases on the method mentioned above.

The fact is: Given the existing production and energy construction of the global economy, natural gas will remain the most important production and energy resource for a long time. Surpassing in many aspects other sources of energy, natural gas as a mineral, still meets the requirements of the Fourth Industrial Revolution to a greater degree, and the search for a worthy alternative is the task of the future.

A decrease in natural gas production, as well as a possible decrease in its supply against a background of steady, and in some cases, increasing demand, can lead to deterioration in the qualitative indicators of functioning of the global economy. This contradicts the objective function of the Fourth Industrial Revolution and creates barriers to the accelerated development of post-industrial society. In this context, the role of natural gas could be evaluated from the standpoint of ensuring economic and national security, as well as the global competitiveness of countries that can stably supply natural gas enough to the world market [17].

An analysis of the currently existing gas fields, including an assessment of their environmental safety (in particular, regarding shale gas), as well as the profitability of production and delivery to consumers, demonstrates the need and the possibility of intensifying the process of integrating the Arctic into a unified system of world gas and oil supply. It is widely known that, in modern Russia, oil and gas bearing fields in five areas are used: Nadym-Pur, Pur-Taz, Yamal, Gydansk and South Kara. In the context of regional development, the first four regions practically coincide with the territory of the Yamalo-Nenets Autonomous Region, and the last, fifth - with the Kara Sea [18].

Based on the significance of the problem associated with the delivery of natural gas to consumers, taking into account existing priorities, the emphasis should be on the production of liquefied natural gas. At present, the list of the main consumers of LNG has established (see table 2). The dynamics of LNG consumption by such rapidly developing countries as Japan, South Korea, and China allows us to predict that no noticeable changes in the distribution of gas between them will occur in the next decade. The active economic development of the countries of the Asia-Pacific Region in the framework of the Fourth Industrial Revolution increases their demand for gas as the most environmentally friendly energy resource. Obviously, delivery to some of these consumers (primarily Japan, China, South Korea, Taiwan) LNG using the Northern Sea Route will be the most reasonable solution [20].

Table 2. LNG consumption dynamics (by main consumers), million tons [19]

| Country    | 2016 | 2017 | 2018 |
|------------|------|------|------|
| Japan      | 80   | 83   | 82   |
| South Korea| 33   | 37   | 42   |
Using the Northern Sea Route, it will be possible to deliver LNG to European consumers in the event of an increase in demand that cannot be met with existing gas pipelines [21].

One way or another, the use of an alternative LNG delivery channel (in relation to gas pipelines) can be considered as an element of increasing the stability of energy supply, taking into account the observed trend of decreasing natural gas consumption and switching to LNG consumption. It is also important that the development of new gas liquefaction facilities will require the construction of appropriate vessels - gas tankers. All these changes will positively affect the Russian economy as a whole, providing promising orders to many Russian enterprises, creating additional jobs, contributing to the expansion and modernization of industrial production capacities, as well as expanding the tax base.

The processes taking place recently in the global gas market testify in favor of our proposal. In this market today, there are six countries occupying 60% of the market and have a dominant influence on its development. These are countries such as Qatar, USA, Russia, Australia, Norway and Canada. Over the next ten years, the United States plans to increase its LNG production fivefold, which will allow them to significantly change the composition of the world leaders and, by 2028, significantly reduce the Russian share in this market. Such forecasts based on existing technology that provides higher profitability of gas supply using gas pipelines at a distance of up to 3-4 thousand km. It is obvious that transporting gas at distances exceeding these figures is more cost-effective in the form of LNG [22].

This means that the two presented methods of gas delivery should not consider only as mutually exclusive. Subject to effective organization and management, they will complement each other. Given that, some countries with high positions in the global ranking of gas consumption do not receive gas through pipelines at all, using only LNG (for example, Japan and South Korea), the additional incentives for Russian companies arise. They relate to the development of the Arctic space in order to discovering new gas fields and increasing LNG production.

4. Conclusions
Under the current conditions of globalization, the development of the Russian economy, as well as the national economies of foreign countries, will occur in accordance with the trends emerging in the world market under the influence of the Fourth Industrial Revolution. This entails a number of changes affecting the international specialization of countries and the transformation of demand for key production factors, including energy resources. In this regard, against the backdrop of the achievements of the Fourth Industrial Revolution, new opportunities appear that provide the development at a faster pace of hard-to-reach territories, to which the Arctic belongs.

Efficient and rational use of the natural resources of the Arctic, especially hydrocarbon reserves, will allow Russia to strengthen its position in the global energy market. The delivery of gas to consumers around the world in the form of LNG using the Northern Sea Route will help ensure the sustainability of the global energy market. Strengthening the design of the global market reflects the

| Country | 2013 | 2014 | 2015 |
|---------|------|------|------|
| China   | 26   | 37   | 53   |
| India   | 18   | 18   | 21   |
| Taiwan  | 15   | 16   | 17   |
| Spain   | 10   | 13   | 11   |
| France  | 7    | 8    | 9    |
| Turkey  | 5    | 7    | 8    |
| Italy   | 5    | 6    | 6    |
| Egypt   | 7    | 6    | 2    |
economic interests of both Russia and other countries, ensuring mutually beneficial international cooperation.

Thus, the study demonstrates the importance of the Arctic region in the context of the processes of the Fourth Industrial Revolution. The revealed specialization of this territory ensures its integration in the economic system of the Russian economy and the system of international division of labor. This contributes to the further movement of the world economy and each individual country towards the prosperity and use of the advantages that the Fourth Industrial Revolution brings.

References

[1] Kiselkina O V, Kharlamov A V, Kharlamova T L and Vunotropidi A F 2015 Proc. of the 4th Int. congress ICIBSOS (Kazan) 425-427.
[2] Didenko N I and Romashkina E S 2018 IOP Conf. Series: Earth and Environmental Science Int. Conf. (St. Petersburg) 180(1) 012014 (accessed date: 17.08.2019).
[3] Molodtsov K 2018 Minenergo: geological exploration in the Arctic can be twice as profitable (Russian gazette 64(7527)), https://rg.ru/2018/03/27/minenergo-geologorazvedka-v-artikke-mozhet-stat-v-dva-raza-vygodnee.html (accessed date: 21.09.2019).
[4] Kharlamov A V and Kharlamova T L 2019 Proc. IBIMA 822-830.
[5] Zaychenko I, Gutman S and Kalinina O 2018 Advances in Intelligent Systems and Computing 692 453-462.
[6] Dodds K 2019 Triumphant Geopolitics? Making Space of and for Arctic Geopolitics in the Arctic Ocean, https://www.researchgate.net/publication/331719046_Triumphant_Geopolitics_Making_Space_of_and_for_Arctic_Geopolitics_in_the_Arctic_Ocean_Integrati ng_Leadership_Discernment_and_Spirituality (accessed date: 12.09.2019).
[7] Tonami A 2018 Third World Quarterly 39(3) 1-15 (Taylor & Francis).
[8] Knecht S, Herber A and Stephen K 2018 Governance of Resources for Arctic Sustainable Policy and Practice (GRASP) – Stakeholder Mapping Building Bridges at the Science-Stakeholder Interface (Cham: Springer).
[9] Grinyaev S N 2015 Law and investments 1-2 76-77 (accessed date: 14.08.2019).
[10] Grinyaev S N 2015 Law and investments 1-2 76-77 (accessed date: 14.08.2019).
[11] Analytical review of fuel and energy complex of the Siberian Federal District // Central dispatching Department of fuel and energy complex, http://www.cdu.ru/catalog/informatsionno_analiticheskie_i_graficheskie_materialy/anal iticheski_obzor_toplivno_energeticheskogo_kompleksa_sibirskogo_federalnogo_okrug a/ (accessed date: 26.09.2019).
[12] Tysiachniouk M S and Petrov A N 2018 Energy Research & Social Science 39 29-34.
[13] Didenko N, Skripnik D and Mirolyubova O 2017 Int. Multidisciplinary Scientific GeoConf. SGEM (Albena) 17 577-586.
[14] Onarheim I H, Eldevik T and Smedsrud L H 2018 Journal of Climate 31(12).
[15] Larchenko L V and Gladkiy Y N 2019 IOP Conf. Series: Earth and Environmental Science, 4th Int. Conf. (St. Petersburg) 302 012121.
[16] Dubovik M V, Gubarev R V, Bondarenko N E and Dzyuba E I 2018 International Journal of Pure and Applied Mathematics. 119-10 427-431.
[17] Didenko N, Kulik S, Kikkas X and Kudravtceva R 2018 Int. Multidisciplinary Scientific GeoConf. SGEM (Albena) 18(5.3) 585-592.
[18] Agarkov S, Motina T and Matviishin D 2018 IOP Conf. Series: Earth and Environmental Science Int. Conf. (St. Petersburg) 180 012007 (accessed date: 15.08.2019).
[19] Kolbina E, Timonin I 2018 Global LNG Market: The Illusion of Excess (Moscow: VYGON Consulting), https://docviewer.yandex.ru/view/0/?page=43*&ru (accessed date: 02.09.2019).
[20] K Y Ng A, Andrews J, Babb D and Lin Y 2018 Climate Change and Its Impacts: Opening Up the Arctic Seas for Maritime Transport (Wiley Online Library),
https://www.researchgate.net/publication/323686431_Climate_change_and_its_impacts_opening_up_the_Arctic_seas_for_maritime_transport (accessed date: 29.07.2019).

[21] Lindholt L and Glomsrod S 2018 Energy Economics 70

[22] Ladislaw S and Tsafos N 2019 Energy Spheres of Influence, Center for strategic and international studies, https://www.csis.org/analysis/energy-spheres-influence (accessed date: 16.09.2019).