

New Industrial Space of a Region: Theory and Methodology

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Abstract-New industrial development taking place in the countries worldwide and their regions makes the research of the new industrialisation increasingly relevant. The research has a goal to examine the new industrial space, which is a specific part of economic space having conditions for the development of the new industrialisation and formed by industrial enterprises. The authors regard the new industrial space as a multitude of economic agents distributed within a certain geographic space that are oriented to manufacturing of products and components belonging to the fifth and sixth technological waves and integrated by telecommunications infrastructure into a single production process, as well as a set of flows and connections between them. The method devised for evaluating the state of the new industrial space at the level of regions allows classifying them according to two criteria: level of industrial development and maturity of innovative industrial environment.

Keywords- *new industrial space; region; new industrialisation; regional economy; economic space.*

I. INTRODUCTION

New industrialisation sets the pace and vector for development of the leading economies in the world. In its different faces it is believed to be an economic elixir capable of bringing any country back to the growth path. "In particular, de-industrialisation and the need for re-industrialisation are becoming major concerns in developed countries" [1]. In such expectations, Russia is no exception. The country has turned to the new industrial policy line since the mid-2000s. This fact kindled the interest of domestic researchers and led to a series of publications, which considered both theoretical and practical implications of the new industrialisation for Russia [2]. Yet one question was left outside scholars' attention. If new industrialisation is a part of an economy, can we then suppose that its practical

implementation results in emergence of a specific space where it occurs? The immediate aim of the present paper is to answer it. In particular, this implies elaborating on the theoretical aspects of the concept "new industrial space" and devising a method for evaluating its state.

II. LITERATURE REVIEW

One of the key works that significantly contributed to the theoretical framework of the new industrialisation belongs to Manuel Castells. As far back as in the 1980s he wrote about new industrial space, which emerges due to the spread of high-tech industrial production, particularly, manufacturing based on microelectronics and computers [3] that sets out some special requirements to enterprises' location, which differ from the ones that existed before. The principal reason for this is that companies need the workforce of two types: highly qualified, possessing unique characteristics, and unskilled, employed in routine operations. In the course of empirical research focused on location of processing industry M. Castells, A. Scott, J. Henderson identified a set of specific traits of the new industrial space. According to them, it is characterised by a technological and organisation capability to split production process between enterprises located in different places, simultaneously reintegrating it back through telecommunication connections as well as accuracy and flexibility in component manufacture based on microelectronics [3].

The model of high-tech industry location developed by M. Castells and P. Hall was confirmed by the practice of the Western countries and the USA. According to the creators of the model, one of its principal elements is the location of technological innovation complexes, what they refer to as *millieux of innovation* [3].

The attempt to study the new industrial space at regional level should start with the definition of the process admittedly forming it – the new industrialisation. The new industrialisation has been widely explored in the scholarly literature. Grigory Korovin, a Russian researcher addressing this topic, summarized the main foreign and domestic works in this field (table 1).

TABLE I. MAJOR STUDIES OF THE REINDUSTRIALIZATION PROBLEM IN THE WORLD AND IN RUSSIA [4]

Researchers (organisations)	Research focus and specifics
Gubanov S.S., Musin M., Lyubimtseva S., Naimushin V., Chuprik Yu., Amosov A., Daskovsky V., Kiselev V., Logachev V., Kochergin D., Rogova O., Ryazanov V. et al.	Suggest a new industrialization model, which implies industrialization of economy and vertical integration
Golubovich A., Idrisov A., Inozemtsev V., Titov B., Shpigel M. (All-Russian public organization "The Other Russia")	Develop the concept of reindustrialization, which implies the refusal of raw materials export model of development and use of cutting-edge technologies and achievements
Titov B.Yu., Afontsev S., Galushka A., Dmitriev M., Osipov A., Pototsky I., Yuriev E., Golubovich A. (All-Russian public organization "Delovaya Rossiya" ("Business Russia"))	Develop a new industrialization plan (The Concept 25x25) and a road map for its implementation.
Bodrunov S.D., Lopatin V.N., Okrepilov V.V. (Institute of New Industrial Development)	Design a number of strategic documents and concepts in the field of new reindustrialization
Bazhal Y., Gets V.M., Aleksandrova V.P., Gurzhiy A.M., Danko M.S., Odotyuk I.V. (National University of Kyiv-Mohyla Academy, Ukraine)	Explore problems of Ukraine in scientific justification of economy reindustrialization.
Skiba A.N., Agliullin I.A., Erokhina E.A., Knyazeva E.N., Kurdyumov S.P., Kuznetsov B.L.	Investigate resonance effects in socioeconomic systems within the framework of the system-synergetic approach.
Avdasheva S., Balatsky E., Bezrukov V., Blandinier J.-P., Glisin F., Karacharovsky V., Lapin V., Mironov V., Obukhovich A., Shastitko A.	Scrutinize the role of industrial development in economic development
Glaziev S.Yu., Bendikov M.A., Varshavsky A.E., Dvortsin M.D., Lenchuk Ye.B., Komkov N.I., Frolov I.E.	Explore economic technological and organizational aspects of reforms in industry
I. Miles; R. Barras (University of Manchester)	Examine problems of services industry within new industrial model of development
Fiona Tregenna (Cambridge University)	Considers a wide spectrum of problems connected with deindustrialization of the world economy and employment
Engelbert Westkämper (Universität Stuttgart), Karolina Krupa (Warsaw School of Economics)	Look at the avenues for reindustrialization in Europe and enhancement of the European countries' competitiveness
Adam Szirmai, Wim Naudé, Ludovico Alcorta (United Nations University – Maastricht Economic and Social Research Institute on Innovation and Technology (the Netherlands))	Regard reindustrialization as a new challenge and a perspective development paradigm

Researchers (organisations)	Research focus and specifics
Aysar Philip Sussan (Bethune – Cookman University in Florida)	Puts forward a proposal that reindustrialization balances economy and social development. The scholar studies changes in essence of competitiveness and role of technologies.
Bernard L. Weinstein, John Rees (University of Texas at Dallas, USA), K. Murphy; A. Shleifer; R. Vishny (University of Chicago)	Investigate general problems of reindustrialization and industrial development
Samuel A. Aryeetey-Attoh, Peter S. Lindquist, William A. Muraco, Neil Reid (Cambridge University)	Analyze reindustrialization and decrease in pollution emissions
Amitai Etzioni (George Washington University)	Studies social and psychological aspects of reindustrialization
Roy Rothwell, Walter Zegveld (University of Sussex, England)	Focus on a wide range of industrial development problems
Zhang Yong (Hubei University of Economics)	Researchers reindustrialization problems in the countries of the Southeastern Asia

Not going deeply into the discussion of the concept's essence let us adhere to the following viewpoint. New industrialization is a set of long-term and large-scale technical, technological, innovative and organizational measures and solutions enabling restoring the role and significance of the industry as the basic component of the national economy, qualitatively and quantitatively renewing physical infrastructure, R&D, finance, management, personnel preparation in conjunction with the formation of the fifth and sixth technological waves in the economy" [5]. Given the presented definition, the content of new industrialization processes can be studied in several directions: qualitative parameters of industrial production, technological characteristics of industry, and state of information technologies that ensure the integration of geographically distributed enterprises into a single production process.

In our view, new industrial space can be regarded from two standpoints: (1) as a space formed by industrial enterprises and flows between them [6] in the course of the new industrialization implementation; (2) as part of economic space, where new industrialization unfolds and necessary conditions emerge. Therefore, to characterize it we should apply both the contemporary concepts of new industrialization and new industrial society and the notions of economic space essence.

As for the latter, the current literature shows no consensus on the understanding of the essence of economic space [7, 8], which means there are numerous approaches to its research, each based on its own definition. For the sake of this paper, we take the treatment by Russian academician Pavel Minakir and his colleague Aleksandr Demyanenko, who argue that economic space is a multitude of economic agents distributed within a certain geographic space and interacting with each other in accordance with the economic institutions that are common within this geographic space [9].

The synthesis of the afore discussed viewpoints allows us to formulate the following definition to the concept:

new industrial space is a multitude of geographically distributed economic agents oriented mainly to the production of manufacturing of products and components belonging to the fifth and sixth technological waves and integrated by telecommunications infrastructure into a single production process, as well as a set of flows and connections between them. With certain qualifications, this definition is applicable to different levels of economic space ranging from national to local one.

III. METHODS

To depict the state of the new industrial space we developed a method based on the statistical data gathered and generated by Russia's Federal State Statistics Service. The statistics for the method was selected on the basis of generalized viewpoints on the characteristics of economic space, understandings of the content of the new industrialization processes and suggested definition of the new industrialization space.

The method for determining the state of the new industrial space can be presented as follows.

The first stage of the method is to assess the importance of industry for a territory's economy. For this, relative industrialization coefficient is calculated:

$$I_i = (P_i / P) \cdot (N / N_i) \quad (1)$$

where P_i – the volume of shipped own produced goods, works performed and services rendered in a region i by types of economic activities "Mining and quarrying", "Manufacturing", "Electricity, gas, steam and air conditioning supply", "Water supply; sewerage, waste management and remediation activities" (sections B, C, D, E of the All-Russian Classification of Economic Activities (OKVED-2), respectively); P – the volume of shipped own produced goods, works performed and services rendered in the country by types of economic activities "Mining and quarrying", "Manufacturing", "Electricity, gas, steam and air conditioning supply", "Water supply; sewerage, waste management and remediation activities"; N_i – number of resident population in a region i ; N – number of resident population in the country.

The second stage involves the evaluation of the maturity of innovative industrial environment. For this, we look at regions against the presence of industrial parks, science cities, new industrial cities; evaluate the share of students of higher education institutions in total population being a necessary condition for the new industrial environment; analyze the density of higher education institutions and scientific research institutions; and check the share of innovative industrial production in total industrial production.

The values of the indicators are normalized according to the linear scaling formula. The total is defined as the arithmetic average of the values for each of the indicators considered.

At the final stage, all regions are divided into four groups depending on the level of industrial development and parameters of the innovative environment:

- industrial regions with a developed industrial innovative environment;
- industrial regions with an underdeveloped industrial innovative environment;
- non-industrial regions with a developed industrial innovative environment;
- non-industrial regions with an underdeveloped industrial innovative environment.

IV. RESULTS

The suggested method for evaluating the state of the new industrial space was tested at the example of Russia's regions as a country with strong traditions of industrial development, which is now struggling for the new industrialization of its economy.

In 2017, relative industrialization coefficient for 32 subjects (regions) of the Russian Federation (out of 85) was higher than one, thus, these regions can be referred to as industrial. The remaining regions featured quite a moderate level of industrial development.

Calculations of the share of students of higher education institutions in total population, density of higher education institutions and scientific research institutions, the share of innovative industrial production in total industrial production indicate that 34 regions have a developed industrial innovative environment. Their leadership positions are also validated by the presence of 12 industrial cities in their territory (out of 30 cities totally), 15 closed municipalities (out of 40 municipalities having such status), as well as a number of science cities: Innopolis, Khimgrad Technopolis in the Republic of Tatarstan, Gusev Technopolis in Kaliningrad oblast, Svetograd Technopolis in Belgorod oblast and others [10].

Russia's subjects are distributed between the specified groups in the following manner (figure 1).

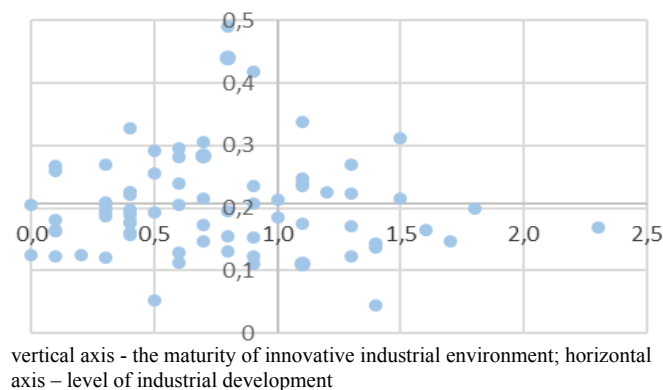


Fig. 1. Industrial and innovation development of Russian regions

The group of industrial regions with a developed industrial innovative environment encompasses the city of Moscow, the city of Saint Petersburg; Omsk, Belgorod, Irkutsk, Samara, Chelyabinsk, Kaliningrad, Nizhny Novgorod, and Sverdlovsk oblasts; the Republic of Tatarstan and Krasnoyarsk kray.

The industrial regions with an underdeveloped industrial innovative environment include Nenets autonomous district, Yamalo-Nenets autonomous district, Khanty-Mansi autonomous district; Tyumen, Sakhalin, Magadan, Kaluga, Lipetsk, Perm, Kemerovo, Arkhangelsk, Vologda, Leningrad, Murmansk, Orenburg, and Tula oblasts; Chukotka autonomous district, the Republic of Sakha (Yakutia), the Republic of Komi, Kamchatka kray.

The non-industrial regions with a developed industrial innovation environment include the Republic of Bashkortostan, the Republic of Udmurtia, North Ossetia - Alania, Adygea, Mordovia, Crimea, Chuvashia; Khabarovsk, Primorsky and Stavropol krais; the city of Sevastopol; Kursk, Ryazan, Orel, Novosibirsk, Voronezh, Volgograd, Tomsk, Tambov, Saratov, Ulyanovsk and Astrakhan oblasts.

The group of non-industrial regions with an underdeveloped industrial innovative environment includes Moscow, Novgorod, Bryansk, Yaroslavl, Pskov, Vladimir, Rostov, Kostroma, Tver, Smolensk, Kirov, Penza, Ivanovo, Amur, and Kurgan oblasts; Krasnodar, Altai, and Zabaikalsky krais; the Republic of Karelia, the Mari El Republic, the Tyva Republic, the Altai Republic, Dagestan, the Karachay-Cherkess Republic, Ingushetia, the Kabardino-Balkar Republic, the Chechen Republic, The Republic of Kalmykia, The Republic of Buryatia, Jewish autonomous oblast.

V. DISCUSSION

The suggested treatment of the new industrial space is the authors' attempt to understand such a complex phenomenon and remains a subject to further discussion. Such a two-in-one approach to characterizing new industrial space (as a new industrialization consequence and as a part of economic space shaping conditions for its deployment) offers a possibility to delve deeper into its essence, and identify the elements of the theoretical platform for studying it within regional science and spatial economics.

The method devised by the authors to diagnose the state of the new industrial space possesses a substantial scientific potential. It is aimed at yielding new scientific and practical results, especially in the field of management of the new industrialization processes at national and regional levels.

VI. CONCLUSIONS

The new industrialization is practically manifested in the emergence of a new type of space, namely the new industrial space. From our study, we can infer that its theoretical foundations are represented by a set of notions of spatial development and new industrialization.

Researching the new industrial space is a non-trivial scientific task, and there is no unified approach to its fulfillment as yet. We believe that a method for its investigation should involve the evaluation of level of industrial development and maturity of innovative industrial environment. Future research is also needed to extend the essential characteristics of the new industrial space and adjust the suggested method for its evaluation by employing it in economic conditions of other countries.

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