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Industrial region in Russia: studying the peculiarities of economic specialization

Análisis de las peculiaridades de la especialización económica de una región industrial rusa

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ABSTRACT:

Active transformation of spatial organization of the Russian economy underlies the necessity to apply new theoretical and methodological approaches to studying spatial organization of the economy of the country (region). The paper frames the concept of promising economic specialization of an industrial region's economic complex and discusses the special features of such a specialization using the case study of one of Russian industrial regions, i.e. Sverdlovsk oblast. The authors explore the geographical and natural resource factors affecting the competitiveness of industrial enterprises with promising economic specialization. The paper determines the role of network structures in enhancing the competitiveness of industries and sectors of the region's economic specialization.
Keywords: economic specialization, production location factors, industry network.

RESUMEN:

La transformación activa de la organización espacial de la economía de Rusia ha fijado la necesidad de utilizar nuevos enfoques teóricos y metodológicos de análisis de la organización espacial de la economía del país (de la región). Ha sido explicada la materia del concepto de la "especialización económica a largo plazo" para las condiciones del complejo económico de una región industrial. Han sido examinadas las peculiaridades de la especialización económica a largo plazo de la industria de la región de Sverdlovsk, una de las regiones de Rusia, como ejemplo. Han sido analizados los factores geográfico y de los recursos naturales que tienen impacto en la competitividad de las empresas de la especialización económica a largo plazo del conjunto industrial. Ha sido definido el papel de las estructuras de red en el aumento de la competitividad de las industrias y los sectores de la especialización económica de la región.
Palabras clave: especialización económica, factores de localización de producciones, formación de redes industriales

1. Introduction

A balanced spatial development of Russia and its regions is a prerequisite for ensuring the effective development of the national economy, social stability, integrity and national security of the country in the changing world. Spatial organization of the Russian economy is being transformed under the large-scale economic reform, political and geostrategic factors, changing international trade conditions and new trends in scientific and technological development. This grounds the necessity to apply new theoretical and methodological approaches to studying the essence of spatial organization of the country's economy.

The need for a deep study of the spatial development aspects in Russia when forming Strategies for the socio-economic development of territories was first declared in the Federal Law "On Strategic Planning in the Russian Federation" (Federal Law No. 172-FZ). In this document, the term "spatial development" denotes improving the settlement system and territorial organization of the economy, including through the implementation of an effective state policy of regional development. According to the Law, the main purpose of spatial development is to guarantee the sustainable and balanced spatial development of the Russian Federation aimed at reducing interregional differences in the level and the quality of life of the population, accelerating the rate of economic growth. It should be borne in mind that small and medium enterprises are currently considered as the main engines of innovation and the main "suppliers" of employment and economic growth (Litau, 2018).

The interregional differentiation in the socio-economic development of the Russian regions is supposed to be smoothed by resolving a number of tasks, such as enhancing competitiveness through the accelerated development of promising regional economic specializations. A *promising economic specialization* is an aggregate of enlarged groups of various types of economic activity (industries) caused by a favorable combination of competitive advantages (spatial factors of location of economic activity types). Such factors encompass the number and density of the population, the quality of human capital, transportation and geographical location, infrastructure, climatic conditions, natural resource potential and other factors. Traditionally the issues of spatial development are widely discussed in the scientific literature. Next we look at some of the theoretical principles of spatial and network economy.

Thus, *the purpose of the present study* is to consider conceptual provisions of modern economics on the problems of Russia's spatial development in terms of promising economic specialization of its regions.

2. Literature review

There is a vast array of research (Tatarkin, 2013; Lavrikova et al. 2017) investigating the concept of space. At the same time, the scientific literature lacks a common approach to the content of this term. The analysis of academic resources allows us to outline three possible definitions interpreting space as (1) territory, (2) environment and (3) economic system.

The concepts of spatial development were actively formulated. Such scholars as Akberdina et al. (2017), Djankov et al. (2006), Llewellyn (1925), Molina et al. (2009), Xu and Singh (2004), made a significant contribution to the development of this scientific area. A number of studies (Lavrikova et al., 2017; Minakir and Demyanenko, 2010; Tatarkin, 2013), highlight that the vivid necessity to account for a spatial factor when forecasting socio-economic development is due to a set of internal and external conditions determining the key factors of the territorial development. The internal conditions for spatial development of a territory encompass the distribution of demographic (Casper, 1984), industrial-economic, scientific-innovative (Darchen and Searle, 2018) and financial-investment potentials (Berduygina et al., 2017), as well as engineering and transport infrastructure (Dubrovsky et al., 2016) and other spatial development factors.

According to the conceptual framework of modern regional economics on the problems of spatial development, the long-term sustainable development of the country and its regions is much dependent on the effective use of the spatial factor for the socio-economic progress.

At the state level, the importance of the spatial factor's effective use is due to the necessity to strengthen Russia's competitive position in the global economy while maintaining and improving the country's national security (the Concept of the Spatial Development Strategy, 2017). At the level of Russia's regions and municipalities, the importance of the spatial factor is justified by a tough competition for investment, finance and labor resources in the context of the refined development objectives, which implies that it is of major priority to create favorable conditions for citizens' life, the development of entrepreneurship and formation of social infrastructure (Gegedyush et al., 2010). At the same time, the issue of competitiveness and sustainable economic growth is constantly at the center of scientific attention and is a frequent subject of study in economic theory (Kiseľáková et al., 2018).

When studying socio-economic systems, such as region, Zhikharevich (2011) proposes the most exhaustive definition of space. He claims that, on the one hand, it is the environment, in which economic activity is formed and conducted and economic processes take place; on the other hand, its uniqueness is based on the foundation of space, i.e. a territory representing the ground layer and the natural basis of space. Currently, the scientific literature also lacks a generally accepted definition of the term *"spatial development"* in terms of socio-economic systems. In our view, the most complete interpretation of the term is given by Lebedinskaya (2018): spatial development is a qualitative change in the properties of space as a result of transformative human activity, under the influence of urbanization, municipal, socio-economic, cultural, demographic, natural and man-made processes.

The formation of network structures in the industry is one of the most important instruments of spatial organization of the country's economy in the context of identification of effective specializations. Moreover, the *network approach* is virtually the major one when justifying the effects of industrial digitalization (Akberdina and Smirnova, 2018). The network approach was first described in the works of Granovetter (1992; 2005) and White (2002), who examined the network organization of the market. By the mid-1990s, thanks to the publications of Burt (1995), Powell and Brantley (1992), the network approach started playing one of the key roles in economics. The particularity of the approach is that it considers not only agents themselves, but also the relationships between them. The structure and the nature of network relationships are treated as key properties of their elements (Bolychev, 2014). Theoretically, Moore's law and Metcalfe's law serve as catalysts for the advancement of digital technologies in industrial markets.

There is a multitude of information-network effects emerging at the level of global information economy. In fact, these are synergy network effects taking various forms. Verian (2005) revealed that the simultaneous use of Moore's law, the Internet, computer involvement and new financial instruments initiated a period of fast innovations. According to Vayber (2003), in the network economy, in contrast to the traditional one, the law of diminishing marginal profitability is no longer applicable. Direct network effects and positive feedback provide increasing marginal profitability. At that, there is a significant scaling in the processes of integration and networkization of developers, producers, sellers and consumers of intellectual information goods, as well as in the processes of giving value to network effects.

Modern realities of economic interaction are beyond the scope of the traditional theory of a country's industrial region, which results in the need to create novel types of organizational structures, i.e. network structures that are currently becoming a distinguishing feature of new economy (Batkovskiy et al., 2018; Mikhaylov, 2018; Mingaleva et al., 2017; Kantemirova et al., 2018).

The review of the literature led us to the need for a practical description of the network structures in industry in terms of specialization and spatial organization of the economy.

3. Material and Methods

In the course of the study, we applied general research methods of scientific abstraction, logic and system-based approaches, methods of comparison; we also analyzed and took into account the extensive experience of developed economies.

Gross value added excluding net taxes has been used as the calculation background. The analysis concerning the GVA dynamics that is included in Real GDP, demonstrates the volumes changes of economic sectors from the development perspective (the primary, secondary and tertiary sectors were considered in the research).

The proportion of the sectors have been calculated by summing up the added values of types of economic activities, which were grouped into three economic sectors by the authors using Fisher-Clark's classification. Give the author's calculation formula:

$$K_{okved} = \frac{\acute{U}O}{GVA} \times 100 \tag{1}$$

where Kokved is the calculation coefficient of net conjugate productions (NCP) based on OKVED; ϵO is the sum of added value of economic activities, included in the economic sector by the authors; GVA – gross value added.

The data has been taken from the "Input-output" table in the system of national accounts (SNA). It can be precisely that the added value in manufacturing output is not enough high in comparison with the primary and the tertiary sectors.

The study is based on statistical data on the industrial development of the region. Let us scrutinize the content of the term "promising economic specialization" interpreted from the perspective of the spatial factor of production location in a region using the case study of a particular industrial region of Russia – Sverdlovsk oblast.

The oblast's economy is historically characterized as *industrial*, in which a substantial part of value added is created in industrial production and around 32% of GRP is produced at industrial enterprises.

In terms of industrial production, Sverdlovsk oblast is among the leading territories of the Russian Federation: it ranks sixth by industrial production in general and fourth by process manufacturing. Today the region's industrial complex preserves a leading position in the context of changing global market conditions, having almost completed the phase of adaptation to new realities of economic development. This enabled the region to reach a 7% increase in industrial production in 2016 in comparison with near-zero dynamics of 2013-2015 (Table 1).

Table 1
Industrial production index (% of previous year)

Territory	2011	2012	2013	2014	2015	2016	2017	2018
Russia	105.0	103.4	100,.4	101.7	96.6	101.1	102.1	102.9
Ural Federal District	101.9	101.6	101.1	100.7	98.1	101.8	103.4	-
Sverdlovsk oblast	106.2	109.6	102.7	102.1	96.9	107.7	104.3	-

Source: Rosstat (http://www.gks.ru).

Sverdlovsk oblast's industrial production has been forming for decades and its structure is rather stable. Its special feature is a *large share of specialization industries (metallurgy and mechanical engineering)* which account for about 70% of the volume of industrial production in the region. It is worth noting that over the past 15 years the structure of the industrial complex has experienced significant qualitative changes. While traditional basic industries still have considerable importance, there has been a significant increase in the development of innovative industrial sectors, such as pharmaceuticals, medical instrumentation and high-tech railway engineering; a regional nanoindustry is being formed, thereby expanding the oblast's export potential.

Thus, given the industrial nature of Sverdlovsk oblast's economy, the concept of promising

economic specialization of the region can be attributed primarily to the regional industrial complex.

Look at the peculiarities of the promising economic specialization of Sverdlovsk oblast's industry considering such crucial spatial factors as the region's geographical location and its natural resource potential.

Geographical factor. Sverdlovsk oblast's geostrategic location is unique due to the junction of regional and global Eurasian continental transport links (Lavrikova et al., 2017). Major international transport corridors pass through the region. The new architecture of Eurasian transcontinental corridors, i.e. the creation of the international transport corridor Western Europe–China, offers new opportunities for the region. Thus, its significant geospatial potential enhances the involvement of Sverdlovsk oblast in global economic relations.

Sverdlovsk oblast's location is also optimal from the standpoint of selling products in the interregional market (including the implementation of major infrastructural projects in new development areas). Transit transport routes that go from the western part of Russia to Asian areas, including the oil and gas areas of the northern part (Khanty-Mansiysk and Yamalo-Nenets Autonomous Districts) pass through the Sverdlovsk region and cross it in the meridional direction from north to south.

The following features characterize the *natural resource factor* of the spatial development:

1. Sverdlovsk oblast demonstrates a significant natural resource potential for the efficient functioning of the specialization industries that embrace metallurgy and mechanical engineering. The region has an extensive raw material base for the metallurgical complex (iron, copper, nickel, manganese ores, bauxite, fluxes, etc.), and metal-intensive heavy engineering enterprises are provided with metal products.
2. Enterprises engaged in the specialization industries exhibit the appropriate production, construction and engineering potential, which guarantee the core competencies in manufacturing of goods competitive in technological markets. The core competencies can include special mechanical engineering as part of the military-industrial sector; instrument engineering; systems for management and automation of technological processes.
3. High-tech productions in the specialization industries and new high-tech industrial sectors (medical instrumentation, pharmaceuticals, etc.) have the core competencies in the production of innovative high-tech goods competitive in new technological markets (domestic and global).
4. The developed innovation infrastructure characterized by modern forms of spatial organization of high-tech industries (clusters, science parks, the special economic zone of industrial-production type "Titanium Valley") encourages the identification of unique highly specialized niches for the region's industry on the map of product markets and advanced technologies on the principles of "smart specialization (Korovin and Averina, 2018).
5. Sverdlovsk oblast's industrial complex shows a considerable potential for the formation of a networked industrial complex, which is due to a high level of cooperative cross-industry interaction and a developed innovative structure.

4. Results and Discussion

Consider a network industrial complex (Fig. 1), which is based on a high degree of consistency of interests and the relationship between its residents, to commercialize the common goals of business structures. It is noteworthy that the term "network economy" is much broader than the definition of digital economy, since the main gist is not technologies, but structural shifts.

The network approach incorporates the organization of various economic sectors that manufacture products to improve the business margin, both throughout the entire chain and conditionally any element of the business structures chain, from the raw material to the final consumer according to the strategically significant activities (Vayber, 2005). For the purpose of efficient operation of companies with network production, it is advisable to achieve a close collaboration between interested parties, as well as with scientific institutions and authorities.

Fig. 1
The structure of the network industrial complex

Network relationships ⬚ Business asset (enterprise, organization)
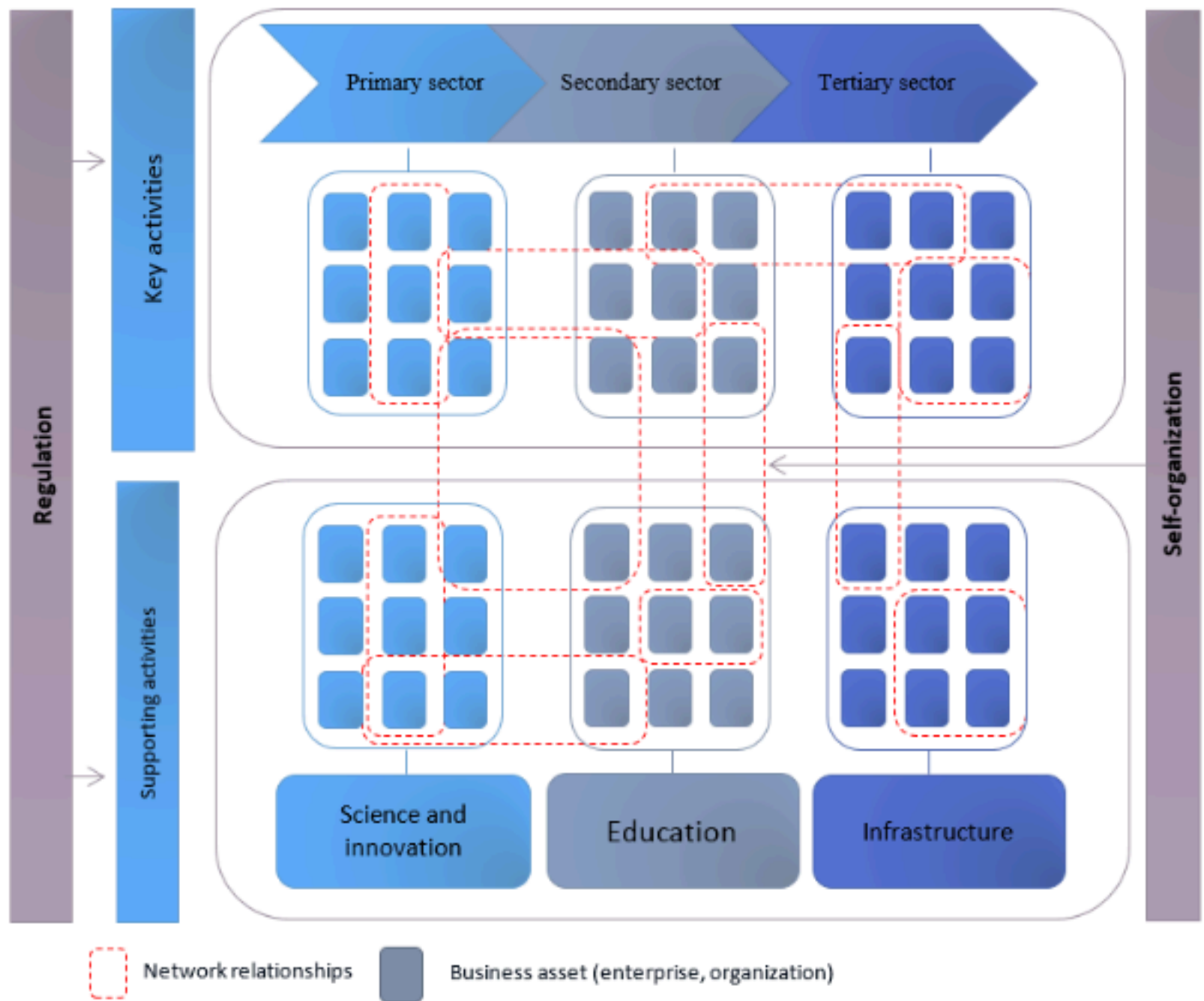
The key attributes and distinguishing features of the network industrial complex are: first, its modularity as opposed to the solidity of production capacities of the existing industry-specific complexes; second, the distribution of production as opposed to the current hierarchical approach; and third, digital communications in the process of production and selling of industrial products.

In the given study, a network industrial complex refers to a set of industrial sectors linked through successive technological and production interaction, involved in the value added formation and participating in network relationships. The first block "Key activities" characterizes the related technological and production interrelations of the reproduction sectors, ranging from the extraction of resources to the release of finished products and the provision of services. The second block "Supporting activities" embraces the sectors for generating knowledge, education and infrastructure (transport, energy). Network relationships emerge between both the enterprises within the first block and with organizations of the supporting block. Activity of enterprises and organizations within each block is regulated by the authorities of different levels, whereas the formation of network relationships is the responsibility of the enterprises and represents a self-organization process.

The first stage in the formation of the industry-specific, and then cross-industry, chain is the optimization of the direct flow of value added from the extraction of resources to the ultimate consumer and reverse cash flow. The cross-industry chain, investigated within the reproduction approach, is a conjugated integrational structure that describes the interaction of various industries and their elements at various stages of production and distribution of product. The conjugated cross-industry chain based on the technological process consists of the primary, secondary and tertiary sectors. At the second stage, individual participants of the conjugated cross-industry chain start cultivating local network relationships both within

the chain and with the sector of knowledge generation (science and innovation), the educational and infrastructural sectors.

Against the background of the direct conjugated interaction, the central strengths of the network relationships are low costs, high speed of innovation introduction, the distribution of the effect between network participants, the shift of interests from own profit to maximizing the profit of the whole chain. At the third stage, the number of participants in local networks starts growing. In the context of the digital industrial revolution, where the boundaries between enterprises and even industries vanish and the production process itself is regarded as a network, the virtual space serves as an environment for arbitrarily complex end-to-end business processes that can automatically perform optimization management of various kinds of resources through the entire value chain of industrial products.

Next, we will take a closer look at the effect of network production and identify industry interconnections (Fig. 2). Agricultural, construction and oil and gas complexes represent the most typical examples of industrial networks. In the Sverdlovsk oblast, there are prerequisites for the development of network industrial complexes, which should also include the metallurgical and the mining complexes. Fig. 2 presents open-ended cross-industry relationships, on which basis we can pinpoint the objective development problems interpreted as threats in network industries.

Fig. 2
The structure of network production using the case study of the
construction complex of an industrial Russian region (Sverdlovsk oblast)

Government | Commercial banks and investment funds | Science and research institutions

Export of ore | Export of engineering products | Import of engineering products

Crude ore
Iron ore mining

Metallurgical production – Production of building metal constructions and products

Mechanical engineering
- Production of lifting and transport equipment
- Production of machinery and equipment for mining and construction

Mining

Nonmetallic raw materials - Stone extraction for construction purposes; - Extraction of limestone, gypsum and chalk; - Development of gravel and sand pits; - Clay and kaolin mining

Production of building materials
- Production of glass and glass products;
- Production of ceramic tiles and slabs; - Production of brick, rood tiles and other building products from baked clay; - Production of cement, lime and gypsum;
- Cutting, processing and finishing stone

Construction

Export of nonmetallic raw | Import of nonmetallic raw | Export of building materials | Import of building materials

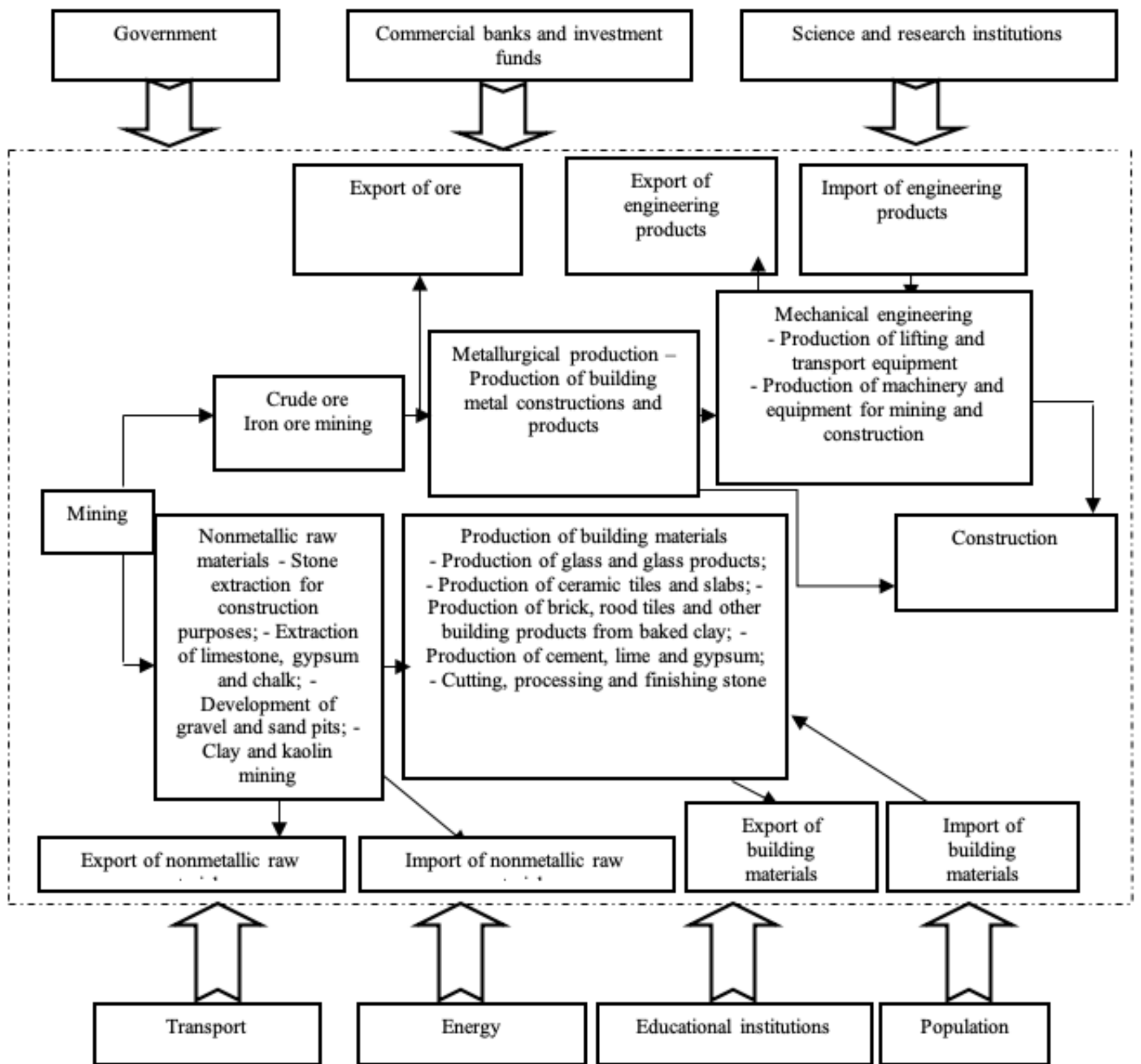Transport | Energy | Educational institutions | Population

Table 2 presents the dynamics of the economic industries in the structure of gross value added in current prices. An analysis of the dynamics allows identifying general trends in the Russian economy and its structure, since the real price level reflects current changes in the ratio of shares of economic sectors.

Table 2
The share of economic sectors in the structure of gross value added
of the construction complex of the Russian Federation in 2012-2016

Indicator	2012	2013	2014	2015	2016
Gross value added in the construction complex, billion rubles	38221.00	41373.00	45117.00	49091.00	47676.45
Primary sector of network conjugated production (NCP), billion rubles	8950.00	9748.00	10287.00	11171.00	11712.49
Primary sector of NCP, %	23.42	23.56	22.80	22.76	24.57
Secondary sector of NCP, billion rubles	25111.00	27133.00	30118.00	33087.00	33898.09

Secondary sector of NCP, %	65.70	65.58	66.76	67.40	71.10
Tertiary sector of NCP, billion rubles	4160.00	4492.00	4712.00	4833.00	2065.87
Tertiary sector of NCP, %	10.88	10.86	10.44	9.84	4.33

Source: (Akberdina and Smirnova, 2017)

The sectors' dynamics in the structure of gross value added shows that the industries of all three economic sectors increased in value terms throughout the entire period, while the share of the extractive industries in the construction complex demonstrated low rates compared to the manufacturing sector. We can conclude that the secondary sector, whose share has been increasing during the last 5 years, underlies the added value chain.

5. Conclusions

The potential of formation and development of a regional network industrial complex is analyzed through the prism of a set of resources, network properties and structural shifts that ensure the stable functioning of the production infrastructure and the socio-economic sphere. It is worth mentioning that, apart from obvious positive effects, formation and development of the network production creates particular risks in the territory's economic development, thereby negatively affecting the region's economic security.

The possible risks to the region's development include worsening trade conditions in partnering countries, asset depreciation and a lop-sided reaction to shocks. The need for forecasting and preventing specific risks and threats requires an appropriate transformation of economic security systems.

Thus, the potential for forming a network industrial complex is a promising avenue for the development of the Russian industry. The central consequence of the formation of network structures is the emergence of synergy effects that allow reducing costs and boosting innovation activity and competitiveness of the industrial complex at both micro- and macro-levels.

Acknowledgments

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