Nexo Revista Científica
Vol. 36, No. 05 (Especial), pp. 180-192/Noviembre 2023

ISSN-E 1995-9516
Universidad Nacional de Ingeniería

http://revistas.uni.edu.ni/index.php/Nexo
http://dx.doi.org/10.5377/nexo.vXXiXX.XXXX

Strategic management of smart specialization in regional economic development: connection of export, sectoral, scientific, and technological competences

Gestión estratégica de la especialización inteligente en el desarrollo económico regional: conexión de competencias exportadoras, sectoriales, científicas y tecnológicas

Julia Lyshchikova*, Elena Stryabkova, Marina Vladyka, Anna Kulik, Yana Bondareva

Belgorod State University. Russia.
*Corresponding author: lyshchikova@bsu.edu.ru

(recibido/received: 17-junio-2023; aceptado/accepted: 01-octubre-2023)

ABSTRACT

The article proposes a methodological approach to determining the priorities of smart specialization based on the conjugation of industry-specific specialization at the global, national, and macroregional levels and the scientific and technological competences of the region in the context of geographical, structural, technological, and cognitive proximity. As exemplified by the Central Black Earth macroregion, the study establishes a managerial matrix and scenario models based on competences. As a result of testing the research tools, a unified template of the managerial matrix for conjugating the directions of export (national, macroregional) and scientific and technological specialization of the macroregion was developed and scenario models for determining the priorities of smart specialization of regions within the Central Black Earth macroregion were built as part of entrepreneurial search procedures with the participation of all parties involved (regional authorities, business community, scientific community, and local residents). The proposed approach will allow all regions, including those not widely included in the global or national division of labor, to find a promising niche for development at the macroregional (local) level. In addition, it considers the possibilities of intersectoral convergence and the use of the accumulated competences of these regions in the field of end-to-end digital technologies.

Keywords: smart specialization, structural and technological proximity, export specialization, sectoral specialization, scientific and technological specialization.

RESUMEN

El artículo propone un enfoque metodológico para determinar las prioridades de la especialización inteligente a partir de la conjugación de la especialización industrial específica a nivel global, nacional y macrorregional y las competencias científicas y tecnológicas de la región en el contexto de factores geográficos, estructurales, tecnológicos, y proximidad cognitiva. Como lo ejemplifica la macrorregión Central Tierra Negra, el estudio establece una matriz gerencial y modelos de escenarios basados en competencias. Como resultado de las pruebas de las herramientas de investigación, se desarrolló una plantilla unificada de la matriz de gestión para conjugar las direcciones de exportación (nacional, macrorregional) y la especialización científica y tecnológica de la macrorregión y modelos de escenarios

para determinar las prioridades de especialización inteligente de las regiones dentro. La macrorregión Tierra Negra Central se construyó como parte de un proceso de búsqueda empresarial con la participación de todos los actores involucrados (autoridades regionales, empresariado, comunidad científica y residentes locales). El enfoque propuesto permitirá que todas las regiones, incluidas aquellas que no están ampliamente incluidas en la división del trabajo global o nacional, encuentren un nicho prometedor para el desarrollo a nivel macrorregional (local). Además, considera las posibilidades de convergencia intersectorial y el uso de las competencias acumuladas de estas regiones en el campo de las tecnologías digitales de extremo a extremo.

Palabras claves: especialización inteligente, proximidad estructural y tecnológica, especialización exportadora, especialización sectorial, especialización científica y tecnológica.

1. INTRODUCTION

The concept of smart specialization developed and widely adopted at the beginning of the 21st century is based on the selection of specific areas of specialization that can become the basis for sustainable socio-economic development of a particular region. Such areas should be connected to the strengths of this region and opportunities for innovation, as well as meet global challenges and market requirements (Foray et al., 2009).

Within the framework of the smart specialization methodology, it is crucial to create special tools and mechanisms that allow regions to realize their ideas through specific projects and products, as well as to promote the commercialization of scientific results and innovative developments. Such instruments include innovation financing mechanisms, technology parks, incubators and accelerators, technology transfer centers, etc. (Foray, 2018). In modern conditions, when innovations become a key factor in economic growth and competitiveness, the methodology of smart specialization plays a vital role in the development strategies of regional economies. It not only creates competitive advantages for the region but also contributes to the development of an innovation ecosystem, effectively links scientific and technological developments with business, and ensures favorable conditions for attracting investment and talented specialists to the region (Dosso, Lebert, 2020).

The development of methodological approaches to determining the priorities of smart specialization in scientific discourse, in addition to the traditional use of localization and specialization coefficients, has recently taken place in the direction of substantiating technological alternatives using the concepts of technological connectivity and diversification (diversity) and local (including implicit) knowledge.

The scientific works by Balland and Boschma (2019; 2021) show that interregional ties have a positive effect on the likelihood of diversification, especially in peripheral regions. However, the authors argue that the connection with other regions is not as important as the connection with those regions that provide additional opportunities. They propose an indicator of relative technological advantage and technological connectivity, which allows to identify other regions as strategic partners in the smart specialization policy depending on their additional opportunities. Another study by Balland and Boschma (2021b) proves that European regions with a high potential for end-to-end digital technologies are more likely to successfully diversify in new digital areas. The conclusions obtained by the authors imply that the state policy aimed at the development of end-to-end digital technologies should be based on the development potential of those digital technologies that the region has since otherwise there is a high risk of investment inefficiency.

The study by Ferreira et al. (2021) presents theoretical and empirical aspects of smart specialization strategies in less developed regions, proving the special role of cooperation networks, attracting investment in R&D from outside the region and creating intra- and inter-regional innovative firms for implementing the regional development policy and forming local management models. It is also worth mentioning the

scientific work by Trippl et al. (2020) which examines the tools by which the organizational and institutional features of regional innovation systems establish the practice of smart specialization in less developed, moderately developed, and developed regions. The authors demonstrate that industrial and organizational density and diversity, institutional structures, systemic features, political opportunities, past experience with innovative strategies, as well as the level of political centralization, create spatial contexts to introduce smart specialization.

In Russian science and practice, there are also studies trying to adapt the European experience and the tools of smart specialization (Zemtsov, Barinova, 2016; Kutsenko et al., 2018). Thus, Averina and Nikulina (2021) emphasize the major role and overall importance of transforming the sectoral structure of the region through the formation of new types of economic specialization in the context of current technological challenges. In their opinion, this will create new innovative and technological factors for regional economic growth and stimulate the integration of the country's regions into a single economic environment. The authors propose to use variant analysis to determine promising and competitive economic specializations by types of regions and to assess the existence and level of development of end-to-end intersectoral technologies in the regions and the possibility of interregional interaction.

Myslyakova et al. (2021) developed a methodological approach to identifying the stages of the formation of smart specialization in the region based on calculating indicators of the localization of industry-specific sections according to the National Classification of Economic Activities 2 – NACE 2, which ensures sustainable development of its economy. This approach allows identifying regions with core specialization and then determining the territories that have the greatest predisposition to innovative transformations. Kalyuzhnova & Violin (2020) conducted a study of the institutional and infrastructural support for the formation of smart specialization in the region and made proposals for adapting Russian regional innovation institutions to stimulate smart specialization.

The article by Kutsenko & Eferin (2019) adapts the methodological approaches of the European observatory for clusters and industrial change to the study of sectoral specialization of regions and trends in its development, supplementing them with the authors' characteristics and proposing a typology of existing specializations. The authors identify four alternative scenarios for the development of specialization industries over a 10-year study period. Based on the analysis of these scenarios for the development of regional sectors, they differentiated structural models depending on the scale and intensity of changes in the structure of the regional economy and the presence or proximity of cities with a million-plus population.

The study of Kotov (2020) is extremely relevant. The author reasonably argues that smart specialization involves the formation of a flexible set of economic activities or interrelated industries depending on the key competences of the region rather than the selection of specific growth points. The author proposed to form a "bundle of competences" after studying the industry, patent, innovation, and publication components of regional specialization, which helps overcome narrow and isolated forecasts for the technological development of territories.

In this regard, the article aims at developing and testing a methodological approach to determining the priorities of smart specialization of the region at the global, national, and macroregional levels based on the conjugation of export, sectoral, scientific, and technological competences with due regard to spatial asymmetry, relative technological advantages, connectivity of industries, digitalization, and technology convergence.

2. MATERIALS AND METHODS

Based on the above-mentioned generalized approaches, as well as the main provisions and measurements of proximity theory that we studied earlier (Lyshchikova, 2022), we can propose a methodical approach to

determining the priorities of smart specialization of regions in the context of the main forms of proximity (Table 1).

Table 1. Methodological approach to the prioritization of smart specialization: main provisions in the context of proximity theory

Type (measurement) of proximity	Directions for defining smart specialization	Indicator	Calculation method
General principle			
Geographical proximity	– The allocation of global, national, and macroregional specialization		
Quantitative analysis			
Structural and technological proximity	– The study of export specialization of the region	Export specialization ratio	The ratio of industry-specific exports in the export of the region and the export of the corresponding industry in the export of the country (according to FEACN 2)
	– The study of sectoral specialization of the region at the national level	National localization factor	The ratio of the value of the industry's products in the total output of the region and the value of the products of the corresponding industry in the country's output (according to NACE 2)
	– The study of sectoral specialization of the region at the macro-regional level	Macroregional localization factor	The ratio of the value of the industry's products in the total output of the region and the value of the products of the corresponding industry in the output of the macroregion (according to NACE 2)
Cognitive proximity	– The study of scientific and technological specialization of the region	Scientific and technological specialization ratio	The ratio of publications in the RSCI core from a certain area in the scientific electronic library in the total number of publications in the RSCI core of the region at a certain point in time, and the ratio of publications in the RSCI core of the corresponding area in the total number of publications from the RSCI core published in the country

*Compiled by the authors according to their own design (Stryabkova, Lyshchikova, 2019)

Based on the studied and generalized sources, we assume that the region has export competences, sectoral competences of the national or macro-regional level, scientific and technological competences if the coefficients of export specialization, localization of the national or macro-regional level, scientific and technological specialization are above 1.

The proposed methodological approach allows to identify the unique competences of the region, i.e., competitive advantages are differentiated depending on export, industry and scientific and technological specialization at the global, national and macro-regional levels. The combination of unique sectoral, scientific and technological competences forms the potential of the smart specialization of the region. In the future, it will help to determine the strategic priorities of smart specialization based on the managerial matrix of conjugation of the results obtained, which includes both key (core) and possible-to-develop (technologically related) unique competences of the region for the implementation of entrepreneurial search.

According to the criterion of geographical proximity we put forward, a special emphasis in the definition of smart specialization is laid on an interregional and macroregional context of interaction. Thus, we selected the Central Black Earth macroregion as an empirical base for our study, which includes five regions (the Belgorod region, Voronezh region, Lipetsk region, Kursk region and Tambov region) under the Strategy for Spatial Development of the Russian Federation until 2025 (Order of the Government of the Russian Federation No. 207-r, February 13, 2019). For quantitative analysis, we used data for these regions for 2020 from the statistical collection "Regions of Russia. Socio-economic indicators" (2022) of the Federal State Statistics Service of the Russian Federation, as well as a sample of data on the publication activity of authors from these regions according to the RSCI as of December 2021.

3. RESULTS AND DISCUSSION

In the process of testing our approach to setting the priorities of smart specialization, first of all, we determined the export competences of the above-mentioned regions. Some results of calculating the coefficient of export specialization of the regions within the Central Black Earth macroregion for 2020 in the heat map format are presented (only for commodity groups of FEACN 2 – Foreign Economic Activity Commodity Nomenclature, in which regions have specialization) in Table 2. Groups of the FEACN 2 classifier, in which the relevant entities have export competences, are highlighted in color.

Table 2. Heat map of export specialization of the Central Black Earth macroregion in 2020

Groups of FEACN 2	Belgorod region	Voronezh region	Kursk region	Lipetsk region	Tambov region
Food products and agricultural raw materials (1-24 groups)	2.35	5.36	2.85	1.89	9.61
Chemical industry products, rubber (28-40 groups)	0.46	5.15	1.43	0.11	1.19
Metals and metal handicrafts (72-83 groups)	5.86	0.37	0.24	7.53	0.04
Machinery, equipment, and vehicles (84-90 groups)	0.41	1.33	0.33	0.48	0.44

Based on the results of calculating the coefficients of export specialization, it can be concluded that all the regions within the Central Black Earth macroregion are characterized by export specialization in the commodity group "Food products and agricultural raw materials"; Voronezh, Kursk, and Tambov regions have export specialization in the commodity group "Chemical industry products, rubber"; Belgorod and Lipetsk regions have export specialization in the commodity group "Metals and metal handicrafts"; the Voronezh region has the third commodity group of export specialization "Machinery, equipment, and vehicles".

Sectoral competences of the national and macroregional levels based on the corresponding localization coefficients are presented (only for sections of FEACN 2, in which the regions have specialization) in the heat map format in Tables 3 and 4. The sections of the FEACN 2 classifier, in which the relevant subjects have sectoral competences, are highlighted in color.

Table 3. Heat map of the national industry specialization of the regions within the Central Black Earth macroregion in 2020

FEACN 2 sections	Belgorod region	Voronezh region	Kursk region	Lipetsk region	Tambov region
Section A. Agriculture, forestry, hunting, fishing and fish farming	3.62	3.18	4.12	2.77	6.87
Section B. Mining	1.45	0.06	0.86	0.04	0.00
Section C. Manufacturing industries	1.16	0.92	1.27	2.29	0.72
Section D. Electricity, gas, steam, and air conditioning supply	0.68	0.86	2.26	0.67	0.58
Section E. Water supply, sewerage, waste management, and remediation activities	0.76	1.72	1.01	0.46	0.45
Section F. Construction	0.84	1.12	0.82	1.08	0.69
Section G. Wholesale and retail trade, repair of motor vehicles and motorcycles	0.95	1.17	0.63	0.64	0.88
Section L. Real estate activities	0.86	0.87	0.84	1.05	0.82
Section M. Professional, scientific and technical activities	0.40	1.10	0.49	0.26	0.41
Section O. Public administration and defense, compulsory social security	0.64	1.02	0.87	0.75	1.20
Section P. Education	0.85	1.18	1.32	0.83	1.17
Section Q. Human health and social work activities	0.81	0.94	1.08	0.81	0.95

Section S. Other service activities	0.95	1.15	1.07	0.93	1.06

Table 4. Heat map of macroregional industry specialization of the regions within the Central Black Earth macro-region in 2020

FEACN 2 sections	Belgorod region	Voronezh region	Kursk region	Lipetsk region	Tambov region
Section B. Mining	2.59	0.12	1.50	0.08	0.01
Section G. Wholesale and retail trade, repair of motor vehicles and motorcycles	1.04	1.32	0.67	0.69	0.97
Section H. Transportation and storage	0.83	1.13	0.92	1.00	1.22
Section I. Accommodation and food service activities	0.67	1.11	1.18	1.10	1.18
Section J. Information and communications	0.84	1.38	0.46	1.12	0.93
Section K. Financial and insurance activities	0.54	1.51	0.97	1.05	0.84
Section L. Real estate activities	0.96	1.01	0.92	1.16	0.93
Section N. Administrative and support service activities	0.78	1.47	0.73	0.85	0.93
Section Q. Human health and social work activities	0.89	1.07	1.18	0.88	1.06
Section R. Arts, entertainment and recreation	1.13	0.81	1.06	0.71	1.51

Tables 3 and 4 show that the Voronezh region has the most diversified structure of sectoral competences at the national and macroregional levels (8 and 7 sections of FEACN 2, respectively). The least diversified range of national and macroregional sectoral competences is common to the Belgorod region (3 and 2 sections of FEACN 2, respectively).

The scientific and technological competences of the regions within the Central Black Earth macroregion in 2021 are presented (only for sections of the RSCI rubricator, in which the regions have specialization) in Table 5.

Table 5. Heat map of scientific and technological specialization of the regions within the Central Black Earth macroregion in 2021

Directions of scientific and technological specialization	Belgorod region	Voronezh region	Lipetsk region	Tambov region	Kursk region
Automation. Computer engineering	1.16	1.34	1.47	3.80	2.18
Biotechnology	0	2.69	0	1.54	0.34
Water industry	0	1.03	0	0	0.59
Geography	2.18	1.74	0.46	0.52	0.51
Geology	0.19	1.29	0.11	0.06	0.11
Mining	1.17	0	0	0	0.24
Demography	0.22	0	1.23	0	0
Department of housing and utilities. Home economics. Household service	0.27	0	0	0	4.11
Computer science	0.83	1.74	1.14	5.71	1.60
History. Historical sciences	0.16	0.30	1.23	0.41	0.45
Cybernetics	1.95	2.09	1.91	1.98	1.51
Forestry and woodworking industry	0.02	3.59	0	0	0
Mathematics	0.88	2.51	3.37	2.36	0.89
Mechanical engineering	0.77	0.69	1.92	1.05	1.86
Medicine and healthcare	0.78	0.77	0.71	0.53	2.60
Metallurgy	6.11	0.29	22.10	0.02	2.27
Metrology	0	0.24	0	2.03	0.11
Mechanics	0.99	1.22	0.91	1.05	1.51
Research-on-research	3.36	0.03	0.25	0.10	0
General social sciences	0.08	0.02	0	0	1.64
General and complex problems of natural and exact sciences	5.22	0	0	0.73	0
General and complex problems of technical and applied sciences	0.33	1.36	4.36	0.20	0.53
Organization and management	0.12	1.56	0	0.46	0.09
Environmental protection. Human ecology	1.84	1.40	0.49	0.89	0.72
Occupational safety and health	0.27	1.07	0	0	2.34
Patent business. Invention. Innovation	0	1.28	0	0	0
Food industry	0.66	5.86	0.36	0.49	1.20
Instrumentation	0.64	0.16	0	3.57	1.37
Communication	0.49	3.11	0.44	1.90	1.98
Agriculture and forestry	1.77	1.93	0.52	0.99	1.57
Sociology	1.10	0.08	0.56	0.08	0.50
Standardization	0	0	0	0	1.63
Construction. Architecture	6.21	1.40	1.84	1.26	1.86
Transport	0.37	0.33	1.15	0.14	0.14

Physics	2.70	2.20	0.45	2.43	1.01
Chemical technology. Chemical industry	5.48	1.21	2.09	11.16	0.64
Chemistry	0.89	2.46	2.00	2.98	0.84
Electronics. Radio engineering	0.66	3.46	0.15	1.25	0.19
Electrical engineering	0.15	0.37	4.77	0.12	0.51
Energy	0.64	0.35	2.30	1.44	0.78

At the next stage, we conjugated the results of a study of export, national, and macroregional sectoral specialization, and scientific and technological competences of the regions within the Central Black Earth macroregion in the form of managerial matrices in order to determine promising areas for seeking the priorities of smart specialization in the above-mentioned regions at the global, national and macroregional levels. A unified template of the managerial matrix for the conjugation of export directions (national, macroregional) and scientific and technological specialization of the macroregion is presented in Table 6.

Table 6. Template of the managerial matrix for the conjugation of export directions (national, macroregional) and scientific and technological specialization of the macroregion

FEACN 2 / NACE 2 sections	Evaluation characteristics	Region 1	Region…	Region N
Section 1	Presence (+) / lack (-) of export / national / macroregional specialization	+	+	+
	Scientific and technological competences	Competence 1 Competence 2 … … Cross-cutting competences	Competence 1 Competence 2 … … Cross-cutting competences	Cross-cutting competences
Section…	Presence (+) / lack (-) of export / national / macroregional specialization	+	-	-
	Scientific and technological competences	Competence 1 Competence 2 … … Cross-cutting competences		
Section M	Presence (+) / lack (-) of export / national / macroregional specialization	+	-	+
	Scientific and technological competences	Competence 1 Competence 2 … … Cross-cutting competences		Competence 1 Competence 2 … … Cross-cutting competences
Cross-cutting scientific and technological competences		Competence 1 Competence 2 … Competence D	Competence 1 Competence 2 … Competence F	Competence 1 Competence 2

Other scientific and technological competences	Competence 1 Competence 2 … Competence K		

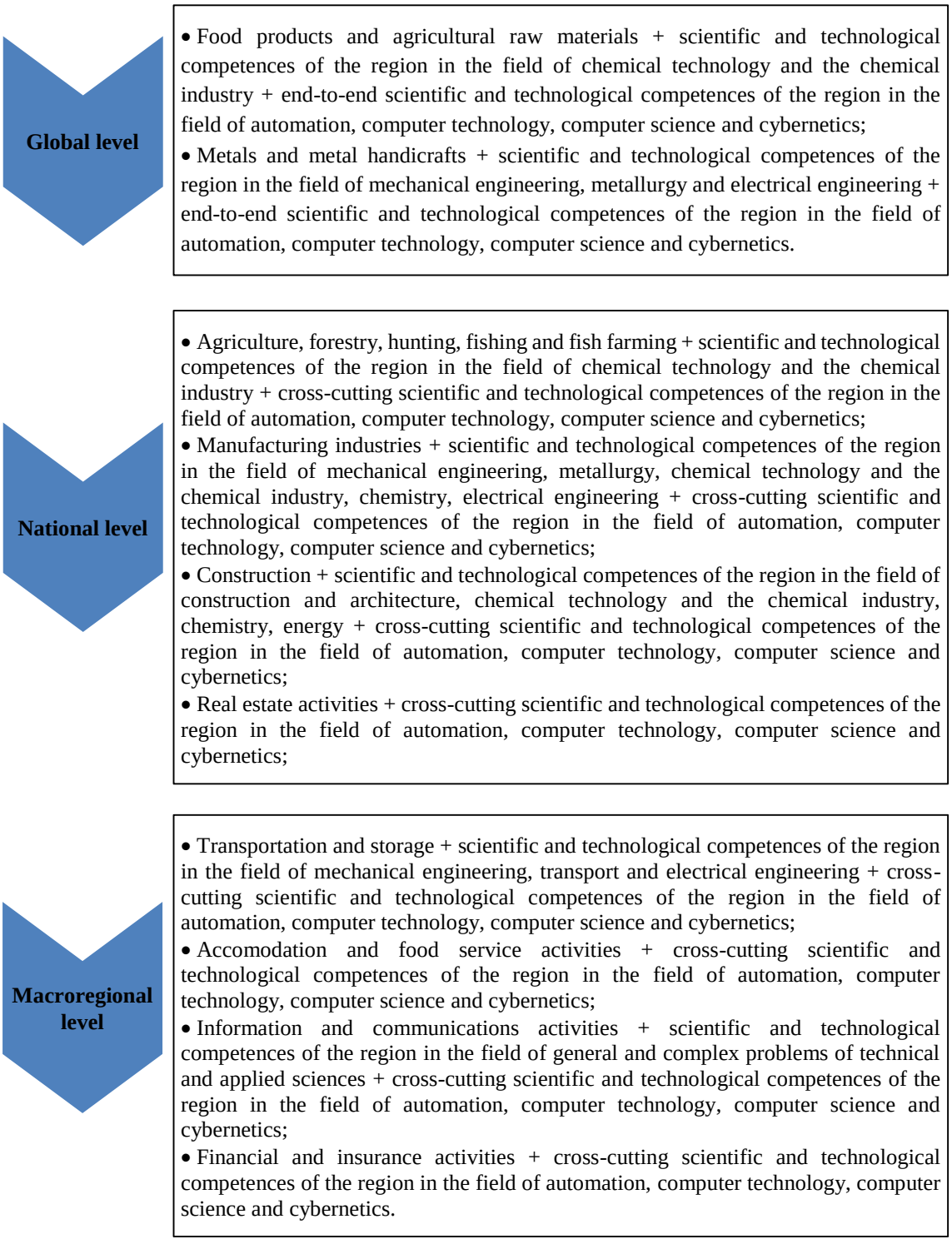

Figure 1. Scenario model for prioritizing smart specialization in the Lipetsk region

Based on the conjugation of the results obtained, we built scenario models for determining the priorities of smart specialization for certain regions as part of entrepreneurial search procedures. The scenario model for determining the priorities of smart specialization in the Lipetsk region is shown in Figure 1.

As part of the constructed scenario models, we have combined export, national, and macroregional specialization and scientific and technological competences of the region level-by-level for the subsequent implementation of entrepreneurial search procedures with all the parties involved (regional authorities, business community, scientific community and local residents). This approach is fully consistent with modern trends in the development of smart specialization tools both in foreign and Russian scientific discourse since it allows even regions that are not included in the global or national division of labor to find a promising niche for development at the macro-regional level. It also considers the intersectoral convergence and use of the accumulated competences in the field of end-to-end digital technologies.

The limitations and debatable issues of the proposed methodological approach that require further research, development and, if needed, adjustment are as follows:

– The difficulty of correlating the classifier of the commodity nomenclature of foreign economic activity (FEACN 2), the all-Russian classifier of types of economic activity (NACE 2) and the thematic rubricator of the international scientometric database RSCI, as well as the need to take into account the priorities of the Strategy for Scientific and Technological Development of the Russian Federation, National Technological Initiatives, etc.;

– The complex selection of the relevant data on the publication activity of Russian scientists by region from the RSCI core;

− The limitations, high degree of aggregation and delay of Russian regional statistics;

– The possibility of expanding the base of sources to determine the scientific and technological specialization of the region by including in addition to publications patents for inventions, industrial designs, utility models and breeding achievements, registration certificates for computer programs, databases, know-how, etc. in the calculations;

– The concretization of approaches in determining scientific specialization (the base priority with due regard to the quartile, citation, affiliation of authors and cooperation between them within a region, macroregion or country);

– The high labor intensity of the study, which conditions the need to explore the possibilities of using big data analysis and artificial intelligence.

5. CONCLUSION

Thus, the methodology of smart specialization consists of the concentration of regional resources and knowledge and the identification of a limited number of socio-economic priorities that should be given consideration. The implementation of smart specialization requires clearly structured monitoring, analysis, and evaluation procedures adapted to the existing regional context in the process of setting strategic priorities based on key principles.

The proposed methodological approach can be useful in the context of growing economic integration and emerging global challenges and threats, reforming the system of territorial strategic planning to ensure the transition to a network-cluster model, creating new spatial formations of an interdisciplinary and

intersectoral nature that make integrated sectors of the new and traditional economy, generating significant multiplier effects, and stimulating an increase in the competitiveness of the regional economy. The approach considers the previously studied concepts and methodologies of smart specialization of territorial development, experience in implementing the principles of smart specialization, the possibility of stimulating interregional and foreign economic relations, structural shifts in reproduction processes, the prospects for convergence (connectedness) of industries, the development of information and communications technologies, and positioning in the technological pyramid.

The proposed smart specialization approach for macroregional and regional spatial development strategies seems to be very promising since it considers export, national, and macroregional industry specialization, and technological connectivity and diversity, which contributes to strengthening interregional interaction and cooperation based on the analysis of a wide range of diverse territorial information. This allows forming a managerial algorithm and mechanism for the effective integration of industrial, scientific, technological, and regional policies.

ACKNOWLEDGMENTS

The research was conducted within the framework of state assignment of the Belgorod National Research University FZWG-2023-0014, the topic of the project “Spatial and network interaction of Russian regions in the context of new challenges of technological development”.

REFERENCES

Averina, L.M., Nikulina, N.L. (2021). Metodologicheskie podkhody k diagnostike i prognozirovaniyu razvitiya regionalnykh perspektivnykh ekonomicheskikh spetsializatsii [Methodological approaches to diagnosing and forecasting the development of regional promising economic specializations]. Vestnik Buryatskogo gosudarstvennogo universiteta. Ekonomikaimenedzhment, 1, 10-20.

Balland, P. A., & Boschma, R. (2021a). Complementary interregional linkages and Smart Specialisation: an empirical study on European regions. Regional Studies, 55(6), 1059–1070. https://doi.org/10.1080/00343404.2020.1861240

Balland, P. A., & Boschma, R. (2021b). Mapping the potentials of regions in Europe to contribute to new knowledge production in Industry 4.0 technologies. Regional Studies, 55(10–11), 1652–1666. https://doi.org/10.1080/00343404.2021.1900557

Balland, P. A., Boschma, R., Crespo, J., & Rigby, D. L. (2019). Smart specialization policy in the European Union: relatedness, knowledge complexity and regional diversification. Regional Studies, 53(9), 1252–1268. https://doi.org/10.1080/00343404.2018.1437900

Dosso, M., & Lebert, D. (2020). The centrality of regions in corporate knowledge flows and the implications for Smart Specialisation Strategies. Regional Studies, 54(10), 1366–1376. https://doi.org/10.1080/00343404.2019.1619923

Ferreira, J. J., Farinha, L., Rutten, R., & Asheim, B. (2021). Smart Specialisation and learning regions as a competitive strategy for less developed regions. Regional Studies. Routledge. https://doi.org/10.1080/00343404.2021.1891216

Foray, D. (2018). Smart specialization strategies as a case of mission-oriented policy-a case study on the emergence of new policy practices. Industrial and Corporate Change, 27(5), 817–832. https://doi.org/10.1093/icc/dty030

Foray, D., David, P.A., & Hall, B. (2009). Smart Specialisation – The Concept. Knowledge Economists Policy Brief, 9(85), 1–5. Retrieved from http://ec.europa.eu/invest-in-research/pdf/download_en/kfg_policy_brief_no9.pdf

Kalyuzhnova, N.Ya., Violin, S.I. (2020). Umnaya spetsializatsiya rossiiskikh regionov: vozmozhnosti i ogranicheniya [Smart specialization of Russian regions: opportunities and limitations]. Ekonomika, predprinimatel'stvo i parvo, 10(10), 2457-2472.

Kotov, A.V. (2020). Metodicheskii podkhod k opredeleniyu umnoi spetsializatsii regionov Rossii [Methodological approach to the definition of smart specialization of Russian regions]. Region: Ekonomika i Sotsiologiya, 2(106), 22-45.

Kutsenko, E., Eferin, Y. (2019). “Whirlpools” and “Safe Harbors” in the Dynamics of Industrial Specialization in Russian Regions. Foresight and STI Governance, 13(3), 24-40. https://doi.org/10.17323/2500-2597.2019.3.24.40.

Kutsenko, E., Islankina, E., Kindras, A. (2018). Mozhno li byt umnym v odinochestve? Issledovanie innovatsionnykh strategii rossiiskikh regionov v kontekste umnoi spetsializatsii [Can you be smart alone? Research of innovative strategies of Russian regions in the context of smart specialization]. Forsait, 12(1), 25-45.

Lyshchikova, J.V. (2022). Interregional interaction in the conditions of digitalization: analysis of programmes of the European Union (EU) for supporting cooperation across borders in the context of the proximity theory development. Relacoes Internacionais no Mundo Atual, 1(34), 98-116. https://doi.org/10.21902/Revrima.v1i34.5623.

Myslyakova, Yu.G., Shamova, E.A., Neklyudova, N.P. (2021). Key steps to smart specialization development of Russian regions. R-economy, 7(2), 123-132. https://doi.org/10.15826/recon.2021.7.2.011

Order of the Government of the Russian Federation No. 207-r. (February 13, 2019). Strategy for Spatial Development of the Russian Federation for the period up to 2025. Retrieved from: http://static.government.ru/media/files/UVAlqUtT08o60RktoOXl22JjAe7irNxc.pdf

Regions of Russia. Socio-economic indicators. (2022). Rosstat: Collection of articles. Moscow. Retrieved from: https://rosstat.gov.ru/storage/mediabank/Region_Pokaz_2022.pdf

Stryabkova, E.A., Lyshchikova, Yu.V. (2019). Razvitie metodicheskikh podkhodov k opredeleniyu prioritetov «umnoi spetsializatsii» territorii [Development of methodological approaches to determining the priorities of smart specialization of territories]. Ekonomika: vchera, segodnya, zavtra, 9(12-1), 73-82.

Trippl, M., Zukauskaite, E., & Healy, A. (2020). Shaping smart specialization: the role of place-specific factors in advanced, intermediate and less-developed European regions. Regional Studies, 54(10), 1328–1340. https://doi.org/10.1080/00343404.2019.1582763

Zemtsov, S.P., Barinova, V.A. (2016). Smena paradigmy regionalnoi innovatsionnoi politiki v Rossii: ot vyravnivaniya k «umnoi spetsializatsii» [Changing the paradigm of regional innovation policy in Russia: from leveling to smart specialization]. Voprosy ekonomiki, 10, 65-81.