

Innovative Development of Belarus

Olena Hrechyshkina*

<https://orcid.org/0000-0003-0653-9210>

Maryia Samakhavets**

<https://orcid.org/0000-0002-4564-2424>

Abstract: This paper is intended to investigate the current status and prospects of the innovative development of Belarus. The estimation of the innovative environment is based on Belarusian official statistical indicators and State program documents. Scientific research methods, the analytical method, comparative analysis are used in the study and treatment of the material. The analysis reveals a relatively low innovative activity of organisations in Belarus. The results indicate the need to further improve the environment for the development of innovations in Belarus.

Keywords: innovations, GII, R&D organisations, innovative development, Belarus.

Introduction

Innovations interact with many processes in economic, social and natural spheres and provide a high level of competitiveness and socio-economic development. Strengthening innovations is one of the most promising directions in modern economic development. It is possible through the implementation of public innovation policy and innovative production. National innovation policy is focused on knowledge and scientific potential of the society. Innovatively active organisations are more competitive in both domestic and foreign markets: they create

* Polesky State University, Economics and Finance Faculty, Department of Marketing and International Management, Dneprovskoy Flotilii Street, 23, Pinsk, 225710, Republic of Belarus.

** Polesky State University, Economics and Finance Faculty, Department of Financial Management, Dneprovskoy Flotilii Street, 23, Pinsk, 225710, Republic of Belarus.

new needs, reduce the cost of goods, improve the image of manufacturers of new products, *etc.* Increase in the share of high-tech products not only strengthens the external sector of the economy (the trade balance) but also leads to the improvement of living standards and nature protection.

The purpose of this paper is to present the current state and prospects of Belarusian innovative development. The conceptual long-term model “Intellectual Belarus” is based on the principle of “overtaking without catching up”.¹ This model is aimed at enhancing and effective use of the competitive advantages of Belarus and includes such elements as digital technologies that form the technological core of the intellectual economy; neo-industrial complex based on robotisation, Internet of things, *etc.*; highly intellectual society in which an individual needs are in harmony with needs of the society. Intellectual component is planned to provide in such areas as transformation of Belarus into IT country, intensification of innovative co-operation between science and innovations, increase of scientific and technical competence, and rise of staff mobility.

Theoretical background

Scientific views on innovations have been associated with such well-known scientists as Schumpeter (1934),² Drucker (1985),³ Freeman (1989),⁴ Nelson (1993).⁵

Different modern authors actively identify different areas of innovative development.⁶ For example, Suglobov and Smirnova propose a network model that is

-
- 1 *Strategiia “Nauka i tekhnologii: 2018–2040” (proekt)* [Strategy “Science and Technology: 2018–2040” (project)], Natsionalnaia Akademiia nauk Belarusi Belarusi, Minsk 2017 [in Russian], p. 7.
 - 2 J. Schumpeter, *Entrepreneurship as Innovation*, [in:] R. Swedberg (ed.), *Entrepreneurship. The Social Science View*, Oxford University Press, Oxford 1934, pp. 51–75.
 - 3 P. F. Drucker, *Innovation and Entrepreneurship: Practice and Principles*, Harper & Row, Publishers, New York 1985.
 - 4 C. Freeman, *Technology Policy and Economic Performance*, Pinter, London 1989.
 - 5 R. R. Nelson, *National Innovation Systems: A Comparative Analysis*, Oxford University Press, Oxford 1993.
 - 6 L. Leydesdorff, H. Etzkowitz, *The Triple Helix as a Model for Innovation Studies*, “Science and Public Policy” 1998, vol. 25, no 3, pp. 195–203, <https://doi.org/10.1093/spp/25.3.195>; F. Moulaert, F. Sekia, *Territorial Innovation Models: A Critical Survey*, “Regional Studies” 2003, vol. 37, no 3, pp. 289–302, <https://doi.org/10.1080/0034340032000065442>; O. S. Eremina, N. V. Demina, *K voprosu o razvitii natsionalnoi innovatsionnoi sistemy Rossii* [On the issue of the development of the national innovation system of Russia], “Kontsept” 2015, vol. 8, pp. 36–40, <https://e-koncept.ru/2015/65008.htm> [accessed 12.05.2021] [in Russian]; O. G. Golichenko, *Natsionalnaia innovatsionnaia sistema Rossii: sostoianie i puti razvitiia* [National innovation

able to stimulate the interaction of scientific, educational, industrial, and business organisations.⁷ Eremina and Demina point to the problem of weak interaction between science and production, as well as the contradictory goals and objectives of scientists and investors.⁸ Moulart and Sekia examine territorial innovation models.⁹ Leydesdorff and Etzkowitz offer Triple Helix of university–industry–government relations,¹⁰ etc.

Innovations are important for the development of Belarus, as they form the basis of socio-economic reforms. The following Belarusian scientists are engaged in scientific research of innovative development: Myasnikovich (2004),¹¹ Nikitenko (2006),¹² Hrechyshkina, Samakhavets (2018),¹³ Zianchuk, Saltanova (2020),¹⁴ Terziev, Klimuk (2021).¹⁵

The authors analysed the innovative development of Belarus on the basis of a comparative analysis with the EU countries to determine the prospects. Evaluation of the innovative development is based on the data of the National Statistical Committee of the Republic of Belarus and State program documents. In particular, these are the State Program of Innovative Development of the Republic of Belarus for 2021–2025, and the National Sustainable Socio-Economic Development Strategy of the Republic of Belarus for the period until 2030. The forecast indicators

system of Russia: state and ways of development], Nauka Publishers, Moscow 2006 [in Russian]; A. E. Suglovov, E. V. Smirnova, *Setevaia model formirovaniia rossiiskoi natsionalnoi innovatsionnoi sistemy* [Network model of the formation of the Russian national innovation system], Infra-M, Moscow 2015 [in Russian]; M. Vemić, O. Hrechyshkina, M. Samakhavets, *Reflections on the EU Innovation Experiences: Concepts and Proposals for Belarus as an EU'S Eastern Partnership Country*, [in:] B. M. Tešanović (ed.), *Strukturne promene i razvoj: monografija*, Univerzitet "Union – Nikola Tesla", Fakultet za poslovne studije i pravo, 2021, pp. 65–105.

7 A. E. Suglovov, E. V. Smirnova, *Setevaia model formirovaniia...*

8 O. S. Eremina, N. V. Demina, *K voprosu o razvitii...*

9 F. Moulart, F. Sekia, *Territorial Innovation Models: A Critical Survey*, "Regional Studies" 2003, vol. 37, no 3, pp. 289–302, <https://doi.org/10.1080/0034340032000065442>

10 L. Leydesdorff, H. Etzkowitz, *The Triple Helix...*

11 M. V. Myasnikovich, *Innovatsionnaia deiatelnost v Respubliki Belarus: teoriia i praktika* [Innovative activity in the Republic of Belarus: theory and practice], Analiticheskii Tsentri NAN Belarusi, Pravo i ekonomika, Minsk 2004 [in Russian].

12 P. G. Nikitenko, *Noosfernaia ekonomika i sotsialnaia politika: strategiiia innovatsionnogo razvitiia* [Noospheric economics and social policy: an innovation development strategy], Belaruskaja navuka, Minsk 2006 [in Russian].

13 O. Hrechyshkina, M. Samakhavets, *Importance of Foreign Direct Investment in Financing for Innovative Development of the Republic of Belarus*, "Marketing and Management of Innovations" 2018, vol. 4, pp. 339–348.

14 M. Zianchuk, I. Saltanova, *Foresighting Technological and Innovative Development of Belarus*, "MEST Journal" 2020, vol. 8, no 2, pp. 192–199, <https://doi.org/10.12709/mest.08.08.02.22>

15 V. Terziev, V. Klimuk, *Directions for Modernization of Innovative Youth Startup Design in Belarus*, "SSRN Electronic Journal" 2021, February 17, <https://doi.org/10.2139/ssrn.3791203>

of innovative development of the Republic of Belarus for 2021–2030 were systematised on that basis.

A comparative analysis of the innovative development of Belarus and the EU was carried out using the Global Innovation Index (GII) 2020, as well as relative indicators of the development of science and technology of the World Bank database for 2009–2018 (research and development expenditure (% of GDP), high-technology exports (% of manufactured exports)).

According to the National Statistical Committee of the Republic of Belarus for assessing the science and innovation development of Belarus an analysis research and development organisations (R&D organisations), and an analysis of the volume of scientific and technical activities of these organisations was conducted. Belarusian R&D organisations were researched in terms of their belonging to the public, commercial and non-profit sector, as well as to the higher education. To evaluate the innovative development of the Republic of Belarus, an analysis of innovatively active organisations was conducted, the dynamics of the shipped and innovative industrial products were analysed.

Scientific research methods (analysis, synthesis, comparative method, deduction, induction, classification, systematisation, scientific abstraction, *etc.*), analytical method and statistical analysis were used in the study and treatment of the material.

Evaluation of Innovative Development of Belarus

One of the indicators that allow to assess the level of innovative development of Belarus and compare it with the EU countries is the GII. In 2020, the GII was compiled for 131 countries. Belarus rank has risen from 72th to 64th place in 2020. However, the methodology for calculating GII undergoes some changes annually, so this improvement in position is a relative. The EU countries have significantly higher innovation development ranks than Belarus. Belarus income level was upper middle, unlike the most EU countries. In addition, a comparison of the Innovation Input Sub-Index rank and Innovation Output Sub-Index rank for Belarus leads to the conclusion that the available resources and conditions for innovation are used not efficiently.

GII identified strong and weak indicators of innovative development of Belarus. Strong indicators include the following: government funding/pupil, secondary, % GDP/cap (8); pupil teacher ratio, secondary (16); tertiary enrolment, % gross (10); graduates in science & engineering, % (11); ICT access (19); applied tariff rate, weighted avg., % (21); females employed w/advanced degrees, % (2);

ISO 9001 quality certificates/bn PPP\$ GDP (5); ICT services exports, % total trade (15); and mobile app creation/bn PPP\$ GDP (1). Weak indicators include the following: regulatory quality (111); rule of law (116); global R&D companies, avg. exp. top 3, mn US\$ (42); GDP/unit of energy use (99); microfinance gross loans, % GDP (82); venture capital deals/bn PPP\$ GDP (76); computer software spending, % GDP (104); global brand value, top 5,000, % GDP (80); national feature films/mn pop. 15–69 (107); and printing & other media, % manufacturing (91).

Based on this, it is clear that the most problematic are such sub-pillars, as Regulatory environment, Credit, Investment, and Creative goods and services. The strongest are such sub-pillars, as Education, Tertiary education, Knowledge workers, and Online creativity. Further innovative development of the Republic of Belarus should be aimed at maintaining and strengthening strong indicators and finding ways to strengthen weak indicators by adapting to changing market conditions, increasing the competitiveness and innovativeness of products, and improving the innovation policy and investment attractiveness of the country.

Dynamics of science and technology development indicators is also provided in the World Bank database. In Belarus compared to the EU Research and development expenditures have been significantly lower than in the EU (Figure 1) and tend to decrease.

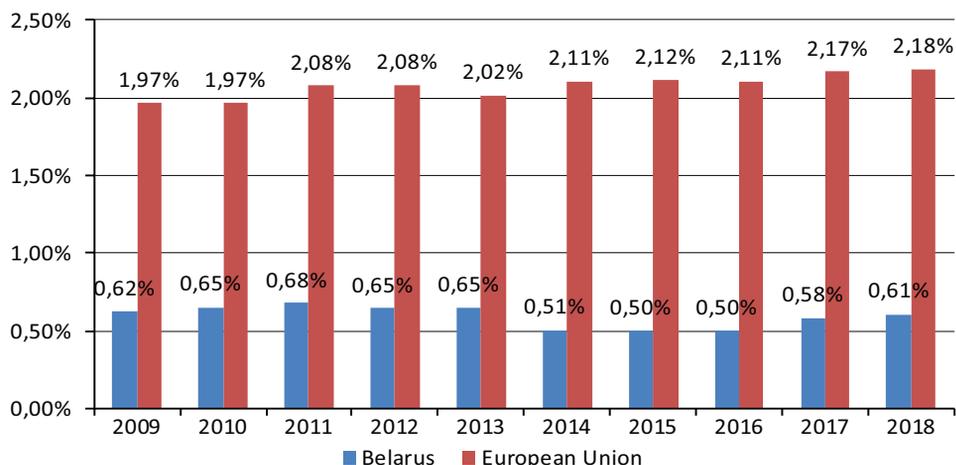


Figure 1. Dynamics of Research and development expenditures (% of GDP)

Source: research of the authors based on the World Bank Database, <https://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS?locations=BY-EU> [accessed 12.05.2021].

According to the World Bank, the high-technology exports indicator in Belarus is significantly lower than in the EU (Figure 2), which points out a significant gap in the innovative development of Belarus from the EU countries.

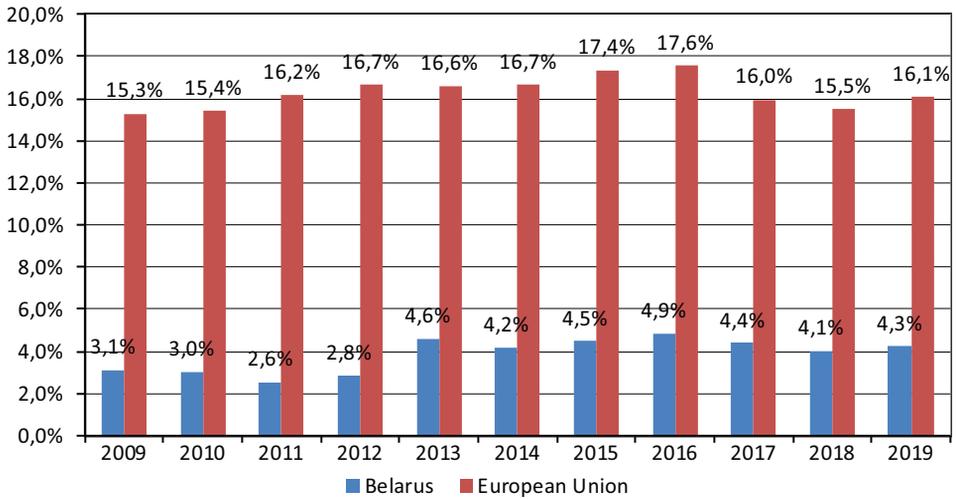


Figure 2. Dynamics of high-technology exports (% of manufactured exports)

Source: research of the authors based on the World Bank Database, <https://databank.worldbank.org/reports.aspx?source=2&country=BLR#> [accessed 12.05.2021].

In addition, on the basis of official statistical indicators of the innovative development of Belarus, the following trends in the development of science and innovation are identified:

1. The total number of R&D organisations **actually** increased slightly from 2009 to 2019, by 14 units (2.8%), and amounted to 460 units. Of these, 89 organisations (19.3%) were public, 296 organisations (64.3%) were commercial, 1 organisation (0.2%) was non-profit, and 74 organisations (16.1%) carried out their activities in the higher education system.
2. The number of R&D employees decreased by 4706 people (by 14.5%) for the period 2009–2019 and amounted to 27,735 people, including 608 doctors of sciences (2.2%) and 2,833 candidates of sciences (10.21%). In 2019, 24.2% (6,706 people) of the staff was employed in the public sector, 65.5% (18,145 people) of in the commercial sector, and 10.4% (2,883 people) in the higher education system.
3. Internal R&D spending increased significantly during 2009–2019, including by BYN 302.5 million (63.6%) for 2016–2019, and amounted to BYN 777.8 million. Internal R&D spending consisted of 90.5% of current cost (BYN 703.7 million) and 9.5% of capital cost (BYN 74.1 million). The structure of internal R&D spending by sectors was presented as follows: in the public sector BYN 195.4 million (25.1%), in the commercial sector BYN 503.8 million (64.8%), and in the higher education BYN 78.7 million (10.1%).
4. Financing of internal R&D spending in 2019 was mainly from budget funds in the amount of BYN 344.1 million (44.28%), and from its own resources in the amount of BYN 264.1 million (34.0%). Foreign investment, includ-

ing foreign loans and borrowings, amounted to BYN 74.4 million (9.6%). Budgetary funds were allocated mainly to agriculture, forestry and fisheries (54.2%), own funds to industry (83.9%), and funds of foreign investors for professional, scientific and technical activities (13.1%).

5. The volume of scientific and technical activities of the R&D organisations increased significantly in 2009–2019, including by BYN 208.9 million (35.0%) for 2016–2019, and amounted to BYN 805.5 million.
6. The number of innovatively active industrial organisations increased by 171 units (by 73.1%) and amounted to 405 organisations. Their share in the total number of industrial organisations amounted to 24.5% in 2019.
7. Shipped innovative own production at actual selling prices, net of taxes and fees calculated from revenue, has increased many times over the study period, including by BYN 4,828.6 million (by 46.2%) for 2016–2019 and amounted to BYN 15,288.7 million. The share of shipped innovative production in the total number of shipped industrial production increased by 5.7% in 2009–2019 and amounted to 16.6%. Meanwhile the share of innovative production new to the domestic market in the total volume of shipped innovative production amounted to 45.2%, and new to the world market 1.6%.

According to the experts,¹⁶ Belarus has already provided a framework for the integration of education, science and innovations (the so-called “Knowledge Triangle”) in order to commercialise scientific and technical R&D and develop innovative products. Experts note the orientation of the national innovation system of the Republic of Belarus to State support for new high-tech enterprises and increase their productive capacity. However, the effect is not yet expressed in comparative indicators of their development. At the same time, the new high-tech companies (so-called “gazelles”) are fast-growing, and they are in the early stages of internationalisation.

However, there are also problems in the areas of legislation, organisation, staffing and access to finance. It is recommended to take the following measures to eliminate them: empowering academic mobility; creation of scientific, educational and production centres, complexes, and consortia; improvement of additional education for adults on innovative development; creation of a modern legislative base, which will ensure the activity of business incubators; expansion of ties between the Republic of Belarus and the European Research Area; promotion and increase the prestige of teachers and researchers work; consolidation of young professionals in the scientific and pedagogical staff institutions; introduction and development of financial mechanisms for export lending and leasing.¹⁷

16 *Innovatsii dlia ustoichivogo razvitiia* [Innovation for sustainable development] (Overview), UN, New York and Geneva, 2017, https://www.unece.org/fileadmin/DAM/ceci/publications/IPR_Belarus/_Rus__Innovation4SD_Belarus_-_WEB_VERSION.pdf [accessed 12.05.2021] [in Russian], p. 174.

17 *Ibidem*, p. 143.

In general, therefore, the analysis reveals a relatively low innovative activity of organisations in the Republic of Belarus, their technological backwardness, which is the reason for the poor competitiveness of Belarusian products in foreign markets.

Strategic Approaches for Innovative Development of Belarus

The State Program of Innovative Development of the Republic of Belarus is the main document on the implementation of the strategic directions of the public innovation policy (Table 1). It is formed for a five-year period and focused on achieving the priorities of socio-economic development of Belarus for 2021–2025 in the field of effective investments and accelerated development of innovative sectors of the national economy.

Table 1. Evolution of available State Programs of Innovative Development of Belarus

Characteristics	State Program of Innovative Development of the Republic of Belarus for 2011–2015	State Program of Innovative Development of the Republic of Belarus for 2016–2020	State Program of Innovative Development of the Republic of Belarus for 2021–2025
Objective	Creation of a competitive, innovative, high-tech, resource- and energy-saving, and green economy	Quality growth and competitiveness of the economy	Achievement of the level of innovative development of the leading countries in Eastern Europe based on the implementation of the intellectual potential of the Belarusian nation
Main goals	Fundamentally new knowledge-intensive sectors of the economy Growth of value added in production Material, energy and import intensity reduction of production Favourable conditions for technological development of the economy Market development of scientific, technical and innovative products Regional innovative development	Accelerated development of high-tech sectors of the economy, based on V and VI technological modes Implementation of high technologies to traditional sectors of the economy Strengthening the position of Belarus at the markets of high-tech production	Creation of the best conditions for implementation and stimulation of scientific and innovative activities Creation of new existing high-tech sectors Ensuring innovative development of traditional sectors of the national economy at the EU level Consolidation in the world markets high-tech products

Source: research of the authors based on the on the Council of Ministers of the Republic of Belarus Database, <http://www.government.by/upload/docs/file5a5cae06fafe4b28> [accessed 12.05.2021].

Therefore, the State Program of Innovative Development of the Republic of Belarus for 2021–2025 is a logical continuation of the previous one. The innovative development strategy of Belarus consists in synthesis of implementation of technologies of V and VI technological modes, and innovative development of traditional sectors of the economy.

Table 2 shows summary long-term predictive indicators of innovative development of the Republic of Belarus. It is based on the study of program strategic documents.

Table 2. Evolving predictive indicators of innovative development of Belarus, %

Indicator	2025	2030
Share of innovatively active industrial organisations in the total number of organisations	27.5	30.0
Share of innovative products shipped in the total volume of products shipped by industrial organisations	23.0	25.0
Share of exports of high-tech products in the total volume of exports		
Share of extra budgetary sources in the domestic R&D costs	65.0	70.0
Domestic R&D costs, % of GDP	2.7	3.0
Share of high-tech activities in the industrial production	7–8	8–10

Source: research of the authors based on the Ministry of Economy of the Republic of Belarus Database, <http://www.economy.gov.by/uploads/files/NSUR2030/> [accessed 12.05.2021].

Achievement of the planned indicators will provide transition of the Republic of Belarus to a qualitatively new stage of economic and innovative development. It will increase the competitiveness and investment attractiveness to ensure more effective use of available resource and intellectual potential, transform the structure of the economy of the Republic of Belarus by the transition to a high-tech production method.

Conclusion

Innovations in Belarus are determined by both enterprises' innovation capability and innovative development at the national level. Belarus rank has risen to 64th place in 2020 among 131 countries in the GII. The weak indicators of Belarus in the GII include rule of law, regulatory quality, computer software spending and others.

The main trends in Belarusian innovative development during 2009–2019 are as follows: the number of R&D organisations increased; the number of R&D employees decreased; internal R&D spending increased significantly; financing

of internal R&D spending was mainly from budget funds; the volume of scientific and technical activities of the R&D organisations increased significantly; the number of innovatively active industrial organisations increased; shipped innovative own production increased many times over the study period.

State Program of Innovative Development of the Republic of Belarus for 2021–2025 is the main document on the implementation of the strategic directions of the innovation policy in Belarus nowadays. The strategic approach for innovative development of Belarus is the synthesis of implementation of technologies of V and VI technological modes, and innovative development of traditional sectors of the economy.

References

- Drucker P. F., *Innovation and Entrepreneurship: Practice and Principles*, Harper & Row, Publishers, New York 1985.
- Eremina O. S., Demina N. V., *K voprosu o razvitiu natsionalnoi innovatsionnoi sistemy Rossii* [On the issue of the development of the national innovation system of Russia], “Kontsept” 2015, vol. 8, pp. 36–40, <https://e-koncept.ru/2015/65008.htm> [accessed 12.05.2021] [in Russian].
- Freeman C., *Technology Policy and Economic Performance*, Pinter, London 1989.
- Golichenko O. G., *Natsionalnaia innovatsionnaia sistema Rossii: sostoianie i puti razvitiia* [National innovation system of Russia: state and ways of development], Nauka Publishers, Moscow 2006 [in Russian].
- Hrechyshkina O., Samakhavets M., *Importance of Foreign Direct Investment in Financing for Innovative Development of the Republic of Belarus*, “Marketing and Management of Innovations” 2018, vol. 4, pp. 339–348.
- Innovatsii dlia ustoichivogo razvitiia* [Innovation for sustainable development] (Overview), UN, New York–Geneva 2017, https://www.unece.org/fileadmin/DAM/ceci/publications/IPR_Belarus/_Rus__Innovation4SD_Belarus_-_WEB_VERSION.pdf [accessed 12.05.2021] [in Russian].
- Leydesdorff L., Etzkowitz H., *The Triple Helix as a Model for Innovation Studies*, “Science and Public Policy” 1998, vol. 25, no 3, pp. 195–203, <https://doi.org/10.1093/spp/25.3.195>
- Moulaert F., Sekia F., *Territorial Innovation Models: A Critical Survey*, “Regional Studies” 2003, vol. 37, no 3, pp. 289–302, <https://doi.org/10.1080/0034340032000065442>
- Myasnikovich M. V., *Innovatsionnaia deiatelnost v Respubliki Belarus: teoriia i praktika* [Innovative activity in the Republic of Belarus: theory and practice], Analiticheskii Tsentri NAN Belarusi, Pravo i ekonomika, Minsk 2004 [in Russian].

- Nelson R. R., *National Innovation Systems: A Comparative Analysis*, Oxford University Press, Oxford 1993.
- Nikitenko P. G., *Noosfernaia ekonomika i sotsialnaia politika: strategiiia innovatsionnogo razvitiia* [Noospheric economics and social policy: an innovation development strategy], Belarускаia navuka, Minsk 2006 [in Russian].
- Schumpeter J., *Entrepreneurship as Innovation*, [in:] R. Swedberg (ed.), *Entrepreneurship. The Social Science View*, Oxford University Press, Oxford 1934, pp. 51–75.
- Strategiia “Nauka i tekhnologii: 2018–2040” (proekt)* [Strategy “Science and Technology: 2018–2040” (project)], Natsionalnaia Akademiia nauk Belarusi, Minsk 2017 [in Russian].
- Suglobov A. E., Smirnova E. V., *Setevaia model formirovaniia rossiiskoi natsionalnoi innovatsionnoi sistemy* [Network model of the formation of the Russian national innovation system], Infra-M, Moscow 2015 [in Russian].
- Terziev V., Klimuk V., *Directions for modernization of innovative youth startup design in Belarus*, “SSRN Electronic Journal” 2021, February 17, <https://doi.org/10.2139/ssrn.3791203>
- Vemić M., Hrechyshkina O., Samakhavets M., *Reflections on the EU Innovation Experiences: Concepts and Proposals for Belarus as an EU’S Eastern Partnership Country*, [in:] B. M. Tešanović (ed.), *Strukturne promene i razvoj: monografija*, Univerzitet “Union – Nikola Tesla”, Fakultet za poslovne studije i pravo, 2021, pp. 65–105.
- Zianchuk M., Saltanova I., *Foresighting technological and innovative development of Belarus*, “MEST Journal” 2020, vol. 8, no 2, pp. 192–199, <https://doi.org/10.12709/mest.08.08.02.22>