

Cluster approach as the innovative model for the development of the regional economy (on the example of the Volgograd region)

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Abstract. Investment and innovation activity is one of the factors in the development of the region, and also contributes to the increase of economic and social potential. To maintain the competitiveness, adapt to changing conditions of the external and internal environment, as well as for the sustainable development of the region, it is necessary to form new achievements of science and technology. In this regard, the innovation activity and innovation policy of the region have the decisive importance. The actual problem is the transition of the country's economy to the innovative development. To solve this problem, it is necessary to develop methods that will restructure all spheres of social relations. The innovative model of economic development requires the formation of the effective transformation of new scientific achievements into new technologies, goods, services in the country and in the regions. They will have their real consumers in the market through the cluster approach.

Keywords: innovation activity, innovation policy, cluster approach, regional economy.

1 Introduction

Innovation activity is a type of activity related with receiving, reproduction of new knowledge and its further implementation in the material sphere of the economy, which means bringing scientific ideas to a specific product or technology.

The implementation of the goals and objectives of the development of innovative activities is carried out through innovative projects and programs, which should be used by the regions to develop and implement the innovation policy.

In 2020, Russia had 47th place in the Global Innovation Index (GII), down one point compared to 2019 (Table 1). The number of countries in determining the GII in 2015 was 141; in 2016 – 128; in 2017 – 127; in 2018 – 126; in 2019 – 129; in 2020 – 131.

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Table 1. Dynamics of Russia's positions in the GII: 2015-2020.

	2015	2016	2017	2018	2019	2020
Global Innovation Index	48	43	45	46	46	47
Resources for innovation	52	44	43	43	41	42
Innovation results	49	47	51	56	59	58

According to the Global Innovation Index -2020, the strengths of the Russian innovation system (Fig. 1) include:

- Human capital and science (30th place in the ranking): higher education (17), including the number of graduates of science and engineering specialties (15), higher education coverage(17) and the position of universities in the QS ranking (21); as well as the ratio of the number of pupils and teachers in secondary education (19).
- The level of market development (55): in general, the block of trade, competition and market scale (18), but primarily the scale of the domestic market (6).
- The level of business development (42): the number of people employed in science - intensive industries (18); number of employed women with scientific degrees (10); payments related to intellectual property (17).
- The development of technology and knowledge economy (50): number of patents for invention (17) and useful model (5) [1, 2].

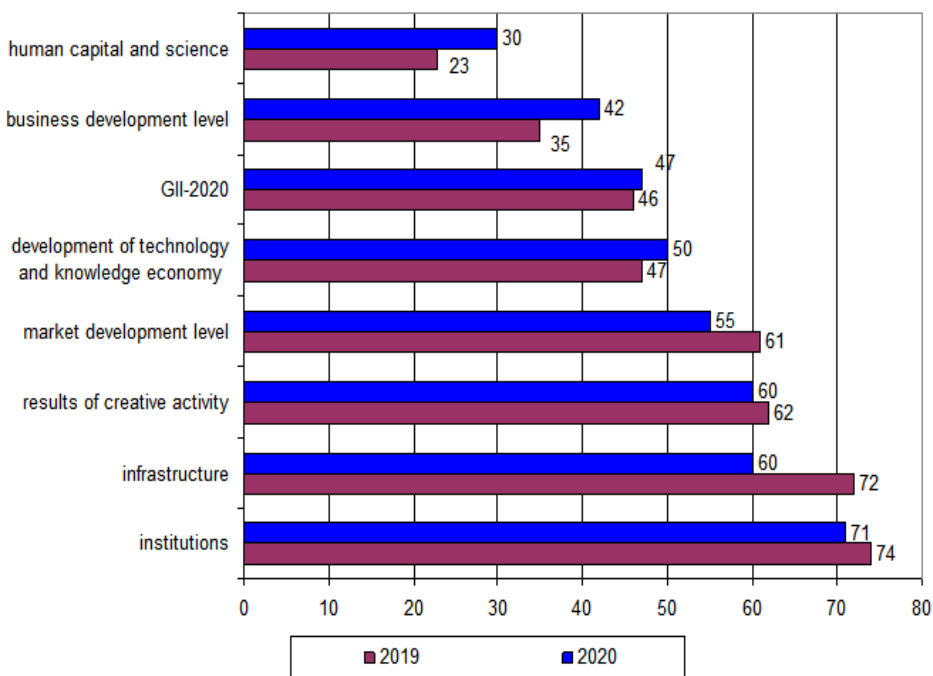


Fig. 1. Positions of Russia in GII-2019 and GII-2020 by elements of the innovation index.

The effectiveness of innovations in Russia is below the expected level at the current values of indicators of GDP per capita and investment in science, technology and innovation.

Lagging behind the leading countries is traditionally determined by the low efficiency of institutions which form conditions for entrepreneurial and creative activity.

Innovative development must be started in the regions of the Russian Federation, because the regions are the engine of innovation activity and development of the whole country. To intensify the innovative activity of the regions, it is necessary to establish a close relationship between the authorities, scientific and financial institutions, the media and consumers.

At present time, there is the uneven innovative development of the regions. There are few regions where innovative projects are being implemented. To attract the participation of regions in innovation activities, it is necessary to create favorable conditions and encourage innovation-active regions [3, 4].

In 2019, there were 4051 scientific research and development companies operating on the territory of the Russian Federation. The largest number of relevant companies is concentrated in the Central Federal District (1456 or 36.2 %) and the Volga Federal District (690 or 17 %).

In 2019, 9839 companies had innovative activities in the Russian Federation. One third of them are in the Central Federal District (Table 2).

Table 2. The level of scientific and innovative activity of companies in 2019.

Territory	Number of companies, units		The level of innovative activity of companies	including: which had research and design departments
	in scientific research and development sphere	with innovative activity		
Russian Federation	4051	9839	9.1	7.1
Central Federal District	1465	3283	10.8	9.0
Northwestern Federal District	521	1185	10.1	8.5
Southern Federal District	317	770	7.5	4.9
North Caucasian Federal District	149	125	1.7	1.5
Volga Federal District	690	2200	11.6	8.3
Ural Federal District	255	828	9.3	7.9
Siberian Federal District	430	1003	7.5	5.5
Far Eastern Federal District	224	445	6.0	3.7

Regional authorities are interested in increasing the innovative potential of the region, because innovative activity contributes to increasing competitiveness, to attract additional funds.

Russian regions are characterized by uneven economic development. Therefore, it is necessary for each region to choose different ways of attracting investments into the economy.

It is compulsory to competently form an innovation policy in the regions for the development and implementation of innovative activities. The goal of the regional

innovation policy is to stabilize and lift the economy, rationalize the use of the regional budget, and create favorable conditions for innovation [5-7].

To achieve the set goals, it is necessary to solve the tasks:

- activation of innovative activities to increase competitiveness and improve product quality;
- attraction of federal and extra-budgetary investments for the implementation of innovative programs and projects;
- stimulating scientific and technical activities, increasing the level of patent protection of products and technologies;
- increasing the focus of innovative activities on solving problems of regional importance;
- development of business planning for innovative activities.

One of the ways to enhance the innovative activity of the region is the use of the cluster approach. The cluster approach means the creation of partnerships between companies, where they share the latest developments with each other and have financial, technical, organizational relations.

The cluster approach to the organization of economic activity in modern conditions is becoming decisive in the global competitive environment, gives advantages to economic entities through the synthesis of management and self-government, state regulation and self-organization, localization and broad international cooperation, increases the competitiveness of firms and companies within the cluster, stimulating direction of innovative development [8-10].

Many countries are actively using the cluster approach to implement their national innovation programs, considering it as a measure to contain the consequences and manifestations of the diverse global economic crisis.

Today, cluster policy is a key instrument for the competitiveness of industries and regions, their economic development in the medium and long term, as well as increasing their innovative potential. State-level cluster projects determine the importance of cluster initiatives and a set of necessary factors for the effective formation of clusters.

2 Materials and methods

The world experience of developed countries shows the efficiency and regularity of the creation of various types of clusters. Over the past 10 years, the creation of clusters has become an important part in the formation of state policy in the field of regional development in many countries. Clusters are one of the most effective tools abroad for the development of small and medium-sized businesses. The rapid development of technologies, logistics, and vehicles has led to the fact that the transfer of information and the movement of funds have become almost instantaneous and the transportation of goods - cheap and fast. In this regard, the most important factors in achieving superiority over competitors are not only innovation and scientific knowledge, but also the relationship between enterprises, the creation of clusters [11, 12].

To create clusters, it is required a set of prerequisites:

- the presence of a set of enterprises, united within the framework of the business process, which use the competitive advantages of the territory and are focused on developing market segments;
- the presence of a significant number of small and medium-sized businesses that use different technology but with some common features, they are engaged in the release of one or more types of products;

- the presence of scientific institutes, qualified workers, free production facilities and infrastructure which are necessary for organizing production;
- well-developed infrastructure required for industrial development;
- regional policy of the authorities, influencing the creation, support and development of clusters.

The creation of clusters in the regions will increase the productivity of enterprises included in the cluster, actively introduce innovative technologies, stimulate the creation of new businesses, and expand the boundaries of the cluster.

The Volgograd Region is a large industrial and agricultural region of Russia. It has the 3rd place in terms of foreign trade among the constituent entities of the Southern Federal District and has the 32nd place among subjects of the Russian Federation. The share of enterprises of the Volgograd region in the foreign trade turnover of the Southern Federal District in January-December 2020 amounted to 10.1 %, and in the foreign trade turnover of the Russian Federation – 0.4 %, including 0.5 % in the all-Russian export (30th place).

Volgograd is a diversified industrial center with a predominance of manufacturing industries. The share of industrial production in Volgograd in the total production of the Volgograd region is about 60 %.

Manufacturing sector has 84 % in the structure of shipped goods, completed works and services of industrial activities of Volgograd. Manufacturing employs 76 % of the total number of workers in industrial enterprises

The Administration of the Volgograd Region approved No. 14-p State Program «On Approval of the State Program of the Volgograd Region» Economic Development and Innovative Economy «on January 23, 2017.

The purpose of the State Program:

- creation of a favorable business climate and conditions for doing business;
- increasing the innovative activity of business;
- increasing the efficiency of state and municipal administration.

New economic realities, the international situation, and other objective factors required adjustments to the system of strategic planning and public administration of the Volgograd region.

World experience shows that the sustainable development of production and the maintenance of its competitiveness in the long term depend not on resource capabilities as on the innovations implemented in production. The factors contributing to the successful development of the innovation system of the Volgograd region include systematic efforts to establish and strengthen cooperation between the production, research and educational sectors [13-15].

The cluster policy is one of the directions of the program implementation. The cluster policy of the Volgograd region is a part of the state socio-economic policy of the Volgograd region. It is a set of legal, economic, informational, consulting, educational, organizational and other measures aimed at strengthening the networks of interconnections between cluster members in order to facilitate access to new technologies, risk distribution in various forms of joint economic activity, including joint access to foreign markets, organization of joint research and development works, joint use of knowledge and fixed assets, acceleration of learning processes through the concentration and contacts of world-class specialists, reduction of transaction costs.

The Center for cluster development is a specialized organization, the purpose of which is to create conditions for effective interaction of cluster members, state authorities and local authorities, investors to develop a territorial cluster, to ensure the implementation of programs for the development of a territorial cluster.

The strengths for the development of industrial clusters in the Volgograd region are:

- diversified sectoral structure of the industrial complex of Volgograd (more than 55 % of industrial enterprises of the Volgograd region are located on the territory of Volgograd);
- the developed scientific and educational complex, high innovative potential;
- the availability of energy resources in the territorial plan;
- the presence of deposits of minerals, oil and gas, mineral raw materials (the share of the production volume of the Volgograd manufacturing sector is 84 % of the total production of the Volgograd region
- the well-established foreign economic relations.

3 Results and discussion

It is also worth considering the characteristics of the region, when taking into account the measures for the economic development of a region through investment and innovation activities. First of all, it is worth paying attention to the geographical location, production potential, consumer ability, the degree of infrastructure development of regions and other factors. There will be a full range of measures for the development of the economy for a specific region after complex analysis of the main indicators [16, 17].

The investment policy pursued in Volgograd is aimed at the effective use of the existing potential. It attracts investments to Volgograd, creates new enterprises, ensures the growth of construction volumes, carries out programs for modernization and restructures the production by the leading industrial enterprises of Volgograd, maintains a favorable external environment and increases domestic demand for products of enterprises for the production of petroleum products, metallurgical and chemical industries.

A necessary condition for the development of competitive production and service on the territory of Volgograd is the transition to the innovative economy. For its transition, it is necessary to form territorial and industrial clusters focused on high-tech competitive industries in priority sectors of the economy.

According to the «Strategy of social and economic development of Volgograd until 2030», industry plays a decisive role in the development of Volgograd in the long term. Therefore, the innovative vector of development does not include a radical change in the specialization of the urban economy. It includes stimulation of the use of new technologies in already existing industrial sectors, the development of cooperation of small and medium-sized businesses with large businesses. Taking into account the existing structure of the Volgograd economy, it is important to open the potential of the most promising sectors of the economy through cluster development mechanisms – the development of cooperative connections between small and medium-sized businesses and large businesses. The most promising sectors for cluster development in Volgograd may be the already established production sectors: chemistry, petrochemistry, metallurgy, construction, as well as such sectors as transport and logistics and agro-industrial.

The implementation of the cluster policy will significantly increase production and innovation activity and strengthen cooperation connections between leading industrial enterprises and small and medium-sized manufacturing businesses, and will expand the sales markets for products of local manufacturers. This approach is consistent with the main directions of regional industrial policy [18-20].

The industrial complex of the Volgograd region includes over 4,200 enterprises and companies, including 545 large and medium-sized enterprises. More than 25 % of the working population of the region is employed in the sphere of industrial production, 25 % of fixed assets are concentrated, about 40 % of the regional domestic product (GRP) is created, about 60 % of tax payments and other revenues are received in the budgets of all levels. The industry of the Volgograd region occupies one of the leading places in the region's economy and has a significant impact on its development. The industry of the

Volgograd region produces 2 % of the total Russian industrial output and about 30 % of the industrial output of the Southern Federal District (SFD). The share of products of industrial enterprises of the Volgograd region in physical terms in the volume of output of the Southern Federal District is about 27 % in oil production, 46 % in oil refining, 24 % in electricity generation, 100 % in production of rolled ferrous metals, tractors and tires, 62 % in production of steel pipes, about 62 % in production of chemical fibers and threads.

50 billion rubles, 3 thousand vacancies, 3 stages and 6 projects - these are the main characteristics of a large-scale investment project to create a chemical cluster on the basis of the Volgograd enterprise «Khimprom». The investment attractiveness of the project for the construction of a chemical cluster in Volgograd was appreciated by the Japanese partners at the G-20 summit in the presence of Russian President Vladimir Putin and Japanese Prime Minister Shinzo Abe. The cluster products will be highly competitive in the world market, including due to the minimum production costs. All the conditions for organizing a chemical cluster in Volgograd are the following: a favorable location, the availability of qualified personnel, a raw material base and infrastructure for the implementation of large industrial projects.

On the territory of the Volgograd region, a chemical and pharmaceutical cluster was created. The purpose of uniting its members is to develop new generations of innovative domestic medicines on the basis of research institutions - members of the cluster for the treatment of socially significant diseases, which are the most frequent cause of mortality and disability in the population of Russia. Also the purpose is the organization of a full cycle of industrial production of generic medicines, including the production of pharmaceutical substances, in order to meet the needs of domestic health care in these medicines on the basis of full import substitution with the total investment of 7.1 billion rubles. Socio-economic effect of the project is the creation of 680 vacancies.

It is planned to create the first bischofite cluster in the Russian Federation for the deep processing of bischofite (magnesium salt) near Volgograd. The scope of the mineral is quite wide: housing and communal services, medicine, agriculture, construction, industry, and so on. But to create such a cluster, cooperation of several commercial structures in different industries will be required. The creation of an industrial cluster is not about uniting territories, but about involving many industries, from mining to processing, into industrial cooperation. The investment project will cost from 5 to 20 billion rubles. Bischofite is produced only in one region of Russia, in the Volgograd region. There is also a similar field in Ukraine, but the reserves are several times less there and the geological conditions are much more complicated. At the same time, Russia accounts for only 12 % of the world consumption of bischofite. 25 % is the share of Europe, the rest is the USA.

There are some advantages for enterprises which are included in the cluster [21-24]:

1. Reducing barriers to entry into the industry, lowering the cost of adapting to the external environment.
2. Support of the authorities in solving common problems.
3. Optimization of production and technological processes.
4. Intensification of innovation, improvement of technologies, close relationship with developers.
5. Providing cheaper access to production factors - technologies, equipment, personnel.
6. It facilitates the exchange of information flows, accessibility to specialized types of information on marketing, technologies.
7. It allows for deeper specialization of suppliers as a result of exploring local market opportunities.
8. Coordination of efforts and a common desire for improvement, which increases the overall quality and efficiency of the work of all participants.

9. Increasing the efficiency of joint marketing, the reputation of the region in the industry.

10. Respond quickly to new customer needs.

11. Advantage in access to new technologies, working methods and supply opportunities.

Thus, the creation of clusters is beneficial both for the enterprises themselves, included in the cluster, and for the regional economy.

Indicators of this economic development of the region can be the following:

- increased employment,
- increase in wages,
- increase in contributions to the budgets of various levels,
- increasing the sustainable development of the region;
- increasing the competitiveness of the regional industry.

Despite all the advantages of creating clusters in the regions, there is a number of factors that impede their development:

1. Low level of infrastructure development;
2. Inconsistency of educational and research programs with the needs of the economy;
3. Lack of interconnection between production and educational, scientific organizations;
4. Low efficiency of industry and professional organizations;
5. Use of short-term planning, there can be real benefits in 5-7 years with cluster management.

The task of the authorities is to contribute to the development of positively influencing factors for the creation and increase of the number of clusters and to overcome obstacles, using all possible means to create a favorable economic climate in the region.

To maintain and stimulate cluster policy in the regions, federal executive authorities need to:

- provide information and analytical support to enterprises within the cluster;
 - develop a general strategy, including goals, objectives, directions for the development of cluster policy;
 - support complex initiatives on a competitive basis for the development of clusters in the region;
 - provide support in the development of international cooperation in the field of cluster policy.
- Regional authorities can do the following for economic development:
 - to analyze the competitiveness of products and services of enterprises in the region;
 - find the point of economic growth, based on the analysis data, it will become the basis for the creation of clusters;
 - to provide support to enterprises belonging to the cluster in carrying out marketing and advertising campaigns, in increasing the competitiveness and output of products to the interregional and foreign markets;
 - to promote the interaction of clusters with scientific institutes, laboratories.

The separate programs for the development of clusters are already being adopted, or organizational structures for their development are being created in some regions. However, there is a problem of insufficient elaboration of regulations governing cluster policy.

4 Conclusions

1. The successful implementation of programs for the formation and stimulation of cluster structures is possible only if there is a general regional development strategy. Regional authorities should provide support to cluster enterprises, act as a communicator, and the

leader of the cluster network. The activities of regional administrations are reduced to the effective coordination of the interests of all cluster members, the creation of conditions and the direct unification of fragments of the regional economy around key competitive activities.

2. To implement the cluster approach, the main efforts of regional authorities should be directed to industrial and innovation policies, strategies and programs of socio-economic development.

3. The implementation of the cluster policy of the Volgograd region contributes to the growth of business competitiveness by realizing the potential of effective interaction between cluster members associated with their geographically close location, including expanding access to innovations, technologies, know-how, specialized services and highly qualified personnel, as well as reducing transaction costs ensuring the formation of prerequisites for the implementation of joint cooperation projects and productive competition.

References

1. G. Barboza, A. Capocchi, *Innovative startups in Italy. Managerial challenges of knowledge spillovers effects on employment generation*, Journal of Knowledge Management, **24(10)** (2020) DOI: 10.1108/JKM-08-2019-0436
2. T. Bielialov, V. Loiko, M. Bihus, Y. Kulynych, K. Omelchenko, *Analysis of competitive strategies of startups under conditions of global challenges*, Academy of Strategic Management Journal, **18** (Special Issue 1) (2019)
3. V. Kryukov, B. Lavrovskii, V. Seliverstov, V. Suslov, N. Suslov, *Siberian Development Vector: Based on Cooperation and Interaction*, Studies on Russian Economic Development **31(5)**, (2020) DOI: 10.1134/S1075700720050111
4. E. Lupova-Henry, S. Blili, C. Dal Zotto, *Clusters as institutional entrepreneurs: lessons from Russia*, Journal of Innovation and Entrepreneurship, **10(1)** (2021) DOI: 10.1186/s13731-021-00149-5
5. M. Battaglia, N. Annesi, I. Pierantoni, M. Sargolini, *Future perspectives of sustainable development: An innovative planning approach to inner areas. Experience of an Italian alpine region*, Futures **114**, 102468 (2019) DOI: 10.1016/j.futures.2019.102468.
6. U. Chomanov, T. Tultabaeva, G. Kenenbay, M. Tultabaev, E. Shoman, *Development of industrial and agricultural enterprises on the basis of innovation management*, Journal of Advanced Research in Law and Economics, **10(8)** (2019) DOI: 10.14505/jarle.v10.8(46).08
7. G. Zagidullina, R. Ivanova, G. Nugumanova, R. Sirazetdinov, A. Zaripova, *The improvement of construction industry innovative potential through the creation of a cluster*, IOP Conference Series: Materials Science and Engineering, **890(1)** (2020) DOI: 10.1088/1757-899X/890/1/012121
8. L. Farinha, J. Lopes, S. Bagchi-Sen, J. Sebastião, J. Oliveira, *Entrepreneurial dynamics and government policies to boost entrepreneurship performance*, Socio-Economic Planning Sciences, **72**, 100950 (2020) DOI: 10.1016/j.seps.2020.100950
9. T. Polyakova, T. Tsurik, *Urban environment quality and its impact on socio-economic development*, Economic Annals-XXI, **180(11-12)** (2019) DOI: 10.21003/ea.V180-17
10. L. Tashenova, A. Babkin, D. Mamrayeva, I. Babkin, *Method for Evaluating the Digital Potential of a Backbone Innovative Active Industrial Cluster*, International Journal of Technology, **11(8)** 2020 DOI: 10.14716/ijtech.v11i8.4537
11. J. Chen, L. Wang, G. Qu, *Explicating the business model from a knowledge-based view: nature, structure, imitability and competitive advantage erosion*, Journal of Knowledge Management, **25(1)** (2020) DOI: 10.1108/JKM-02-2020-0159

12. T. Ljungkvist, J. Andersén, *A taxonomy of ecopreneurship in small manufacturing firms: A multidimensional cluster analysis*, Business Strategy and the Environment, **30** (2) (2021) DOI: 10.1002/bse.2691
13. I. Lopes, *Are intangibles really a source of future economic benefits? Evidence from the technology sector*, Measuring Business Excellence, **23**(4) (2019) DOI: 10.1108/MBE-08-2018-0057
14. U. Mentel, M. Hajduk-Stelmachowicz, *Does standardization have an impact on innovation activity in different countries?* Problems and Perspectives in Management **18**(4) (2020) DOI: 10.21511/ppm.18(4).2020.39
15. E. V. Ilina, A. I. Romanova, O. V. Maksimchuk, A. V. Voronin, *Development of the construction industry in the context of import substitution: Russian experience*, Espacios, **38**(48), 18 (2017)
16. C. Ștefănescu, A. Tiron-Tudor, E. Moise, *Eu non-financial reporting research – insights, gaps, patterns and future agenda*, Journal of Business Economics and Management, **22** (1) (2021) DOI: 10.3846/jbem.2020.13479
17. D. Zaynullina, *The impact of the implementation of an innovative project on the effects arising in the internal and external environment*, IOP Conference Series: Materials Science and Engineering, **890**(1), (2020) DOI: 10.1088/1757-899X/890/1/012176
18. Z. Mohamed, F. Nadzri, S. Qureshi, (...), J. Arifin, N. Yacob, *Attracting inward foreign direct investment: An analysis on e-government practices and ease of doing business among countries in the Asean region*, Contemporary Economics, **14**(4) (2020)
19. I. Onea, *Innovation Indicators and the Innovation Process-Evidence from the European Innovation Scoreboard*, Management and Marketing, **15**(4) (2020) DOI: 10.2478/mmcks-2020-0035
20. D. Reis, A. Fleury, M. Carvalho, *Consolidating core entrepreneurial competences: toward a meta-competence framework*, International Journal of Entrepreneurial Behaviour and Research, **27**(1) (2020) DOI: 10.1108/IJEBR-02-2020-0079
21. S.-O. Caballero-Morales, *Innovation as recovery strategy for SMEs in emerging economies during the COVID-19 pandemic*, Research in International Business and Finance, **57**,101396 (2021) DOI: 10.1016/j.ribaf.2021.101396
22. A. Caputo, S. Pizzi, M. Pellegrini, M. Dabić, *Digitalization and business models: Where are we going? A science map of the field*, Journal of Business Research, 123 (2021) DOI: 10.1016/j.jbusres.2020.09.053
23. Z. Liu, Y. Lu, M. Shen, L. Peh, *Transition from building information modeling (BIM) to integrated digital delivery (IDD) in sustainable building management: A knowledge discovery approach based review*, Journal of Cleaner Production, **291**,125223 (2021) DOI: 10.1016/j.jclepro.2020.125223
24. X. Zhang, X. Ao, W. Cai, Z. Jiang, H. Zhang, *A sustainability evaluation method integrating the energy, economic and environment in remanufacturing systems*, Journal of Cleaner Production, **239**,118100 (2019) DOI: 10.1016/j.jclepro.2019.118100