Analysis and Evaluation of Innovation Activity of the Russian Economy

Ilona Avlasenko(✉), Lyudmila Avlasenko, and Yuri Podkolzin

Don State Technical University, Gagarin Square, 1, Rostov-on-Don, Rostov Region 344003, Russia
avlas333@mail.ru

Abstract. The task of transferring the economy to innovative rails is a priority for Russia on the way to creating a powerful competitive country. The article considers the trends of innovative development of Russia and foreign countries. Today, Russia, which has a number of advantages, needs to transform the world economic relations formed under the influence of scientific and technological progress. The study of the innovative processes of the Russian economy in the light of the existing international competition forces the formation of a new paradigm of economic development. Strengthening its position on the world stage through the introduction of new technologies, the creation of the necessary conditions for innovative development was a priority task for Russia, it would change the structure of the economy in the direction of reducing resource dependence, would ensure an increasing rate of qualitative economic growth and living standards of the population, technological safety of the country. The state of the Russian economy in the field of innovation is analyzed on the basis of indicators of innovative development, Russia's place in the international arena is determined on the basis of world ratings. In the article different obstacles on the way to become a powerful innovative state are also highlighted.

Keywords: Innovation · Innovation policy · Innovative technologies · Technology transfer · Digital economy · Digital technologies

1 Introduction

Demic situation has caused a global economic downturn. Economic implications had affected innovative financing. However, the pandemic had not affected the fact that breakthrough innovation technologies retained their rich potential. Against the backdrop of the crisis, interest in information technology and health care had increased [1].

Against the backdrop of the pandemic, digital transformation is of particular importance, which is one of the main elements of any country's innovation policies. Digital technologies lead to increased competitiveness and economic growth in many countries of the world, contribute to the modernization of industries and the creation of breakthrough technologies [2].

According to Euler Hermes, according to the results of 2020, according to the level of the digital economy, that is estimated by the parameters: market size, a stable business

A. Beskopylny et al. (Eds.): INTERAGROMASH 2022, LNNS 574, pp. 2204–2212, 2023.
https://doi.org/10.1007/978-3-031-21432-5_241

environment, an economic knowledge system, infrastructure, quality of inclusion, Russia was in 38th place in the ranking. Leading positions were taken: in first place - the USA, in second place - Germany, in third place - Denmark. China achieved special success, being in the 4th place in the ranking against 14th position before the pandemic [3].

2 Materials and Methods

The object of the study is the Russian economic system, which is in a state of transition to an innovative type of development.

The subject of the research is the innovative processes taking place in Russia.

Today, Russia, which has a number of advantages, needs to transform the world economic relations formed under the influence of scientific and technological progress.

The study of the innovative processes of the Russian economy in the light of the existing international competition forces the formation of a new paradigm of economic development.

Quantitative and qualitative analysis includes a digital and statistical base in order to identify the direction of the economy, reflecting the dynamics of economic indicators.

The article applies theoretical and methodological approaches to the study of the main economic indicators of innovative development of the Russian economy and the economies of technologically developed countries. Statistical analysis is the foundation of the evidence base [4].

3 Results

Strengthening its position on the world stage through the introduction of new technologies, the creation of the necessary conditions for innovative development was a priority task for Russia, it would change the structure of the economy in the direction of reducing resource dependence, would ensure an increasing rate of qualitative economic growth and living standards of the population, technological safety of the country [5].

The analysis of the main indicators of innovative development of Russia demonstrates the insufficiency of state policy measures aimed at stimulating innovation activities. Russia's innovative activity continued to be extremely low compared to other countries. According to GII 2020, the leader in innovative development are Switzerland, Sweden, the USA, Great Britain, the Netherlands. Russia in this ranking took 47th place in 2019. In the sub index, the resources of innovation (42) Russia was lower than in the results of innovation (58). In the first in the ranking, the second country in Asia got into the top ten - Singapore, which ended up in 8th place.

Figure 1 shows the dynamics of the number of organizations involved in R & D in 2015–2019, demonstrating a decrease in scientific organizations by 4%. An analysis of organizations' structure showed a decrease almost for all types. The number of R&D organizations in higher education decreased from 1,124 in 2015 to 1,057 in 2019. In the public sector, during the analyzed period, the number of scientific organizations decreased from 1560 to 1479 in 2019, by 5.2%, in the private sector the decrease was 26 organizations (1.8%). For non-profit organizations, there is an increase of 55%.

The structure of organizations in the scientific field by the category is as follows: over the period from 2015–2019. The number of research organizations decreased from 1708 to 1618 (5.26%); the number of design organizations was reduced by almost 21% (from 322 in 2015 to 255 in 2019); the number of the design and design and survey organizations was reduced by 62% (from 29 in 2015 up to 11 in 2019).

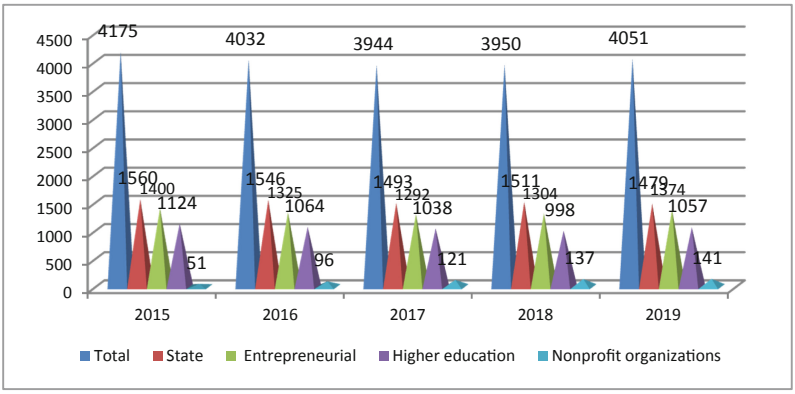

Fig. 1. Number of organizations involved in research and development by sector of activity in 2015–2019.

The negative trend is observed in terms of changing number of scientific staff (Fig. 2). For the period from 2015 to 2019, the total decrease was 7.6%. For comparison, in 2000, 887700 people were employed in the field of research and development. In the public sector, compared to 2015, the number of scientific staff decreased by 14.3%, in the private sector - by 7.1%. Positive changes are observed in the higher education sector [6]. Compared to 2015, in 2019, the increase in the number of scientific personnel amounted to 16.2%. The largest growth was in the sector of non-profit organizations, where the number of scientific personnel increased during the analyzed period by 75.5%.

Negative dynamics can be traced in terms of scientific personnel with scientific degree. For the period from 2015 to 2019. The share of candidates of sciences in the total number of sniffed from 22 to 21.6%, doctors of sciences - from 7.4% in 2015 to 7.1% in 2019.

In the world ranking in terms of the number of scientific personnel in 2019, Russia took 4th place. The leader in this ranking was China - 4381.4 thousand people. In the second place is USA - 1434.4 thousand people, in the third place is Japan - 896.9 thousand people [7].

Domestic research and development costs by source of finance show growth in monetary terms. From 2015 to 2019, the total under-growth for all sources of financing amounted to 24%. But, despite this positive dynamics, as a percentage to GDP the level of expenses grew slightly, having remained almost at the same level, as in 2015 (in 2015–1.36%, in 2019 - 1.03%) (Fig. 3).

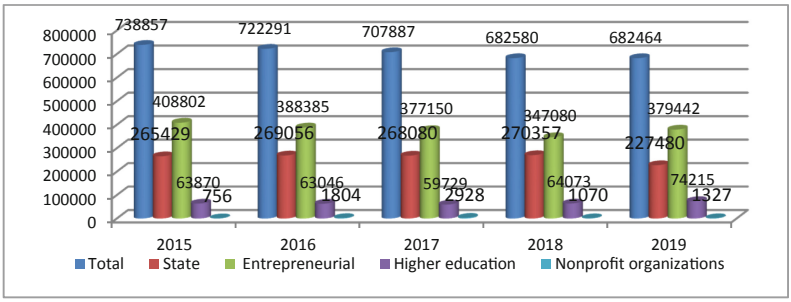

Fig. 2. Dynamics of scientific personnel by activity sectors, 2015–2019.

4 Discussion

In terms of internal research and development costs, the budget was in first place, having 2019 in the overall structure of funding sources in 64.4%. Among the leading countries in terms of science costs from the budget, Russia demonstrates the largest value of this indicator [8].

Comparing the volume of domestic R & D costs by country (Fig. 4), one can trace the leading position of the United States, the amount of investment in science was $581.553 billion in 2019. In second place in terms of domestic costs is China, which spent $468.062 billion on research and development. Japan closes the top three in terms of R & D financing - 171.293 billion dollars. If we analyze domestic costs in % of GDP, then this rating in 2019 was led by the Republic of Korea (4.53%), followed by Japan (3.28%), Germany was in third place (3.13%).

An important indicator of the country's innovative development is the activity of scientific publications in scientific and technical journals, and in journals indexed in international databases (Fig. 5).

As for the number of scientific and technical articles in journals in 2018, Russia entered the top ten countries of the world, taking 7th place: China - 528263; USA - 422808; India - 135788; Germany - 104396; Japan - 98793; Great Britain - 97681; Russia - 81579; Italy - 71240; South Korea - 66376; France - 66352.

In 2019, Russia took 14th place in the world ranking (Web of Science database) - 63,251 articles. The first place was taken by China - 495209 articles, the United States in second place - 489706, closes the top three UK - 155058 articles. In the Scopus database, Russia was placed in 12 position - 73,496 articles. China also leads - 540174 articles, the United States in the second place - 461503 articles, Great Britain got the third place - 146465 articles.

A comparative international analysis of the number of scientific articles that are indexed in international databases shows a small share of Russia in the ranking. In 2019, the ratio of Web of Science and Scopus articles in Russia was 2.91/3.23. In first place is China - 22.77/23.71. The second line was taken by the United States - 22.51/20.26. In third place is the UK - 7.13/6.43 (Fig. 5).

The analysis of patent activity, which is of great importance in assessing the country's investment potential, indicates a deterioration in indicators both for the analyzed period

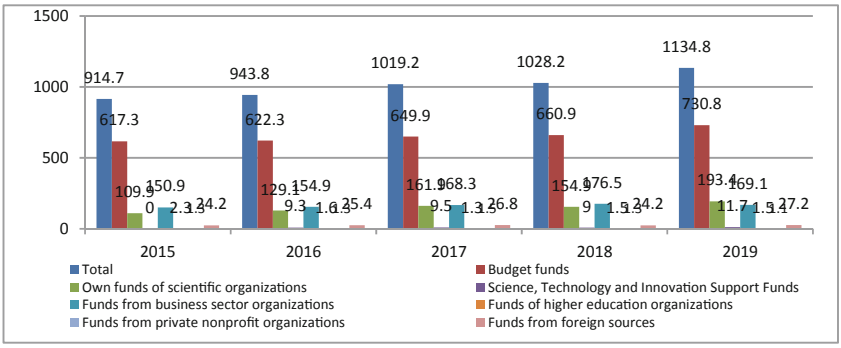

Fig. 3. Internal costs for research and development, according to the sources of funding, billion rubles for 2015–2019.

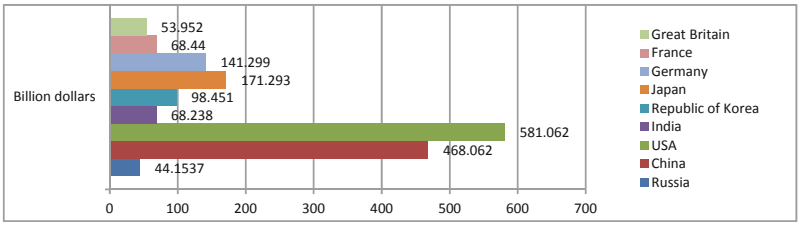

Fig. 4. Internal R&D costs, billion dollars, 2019.

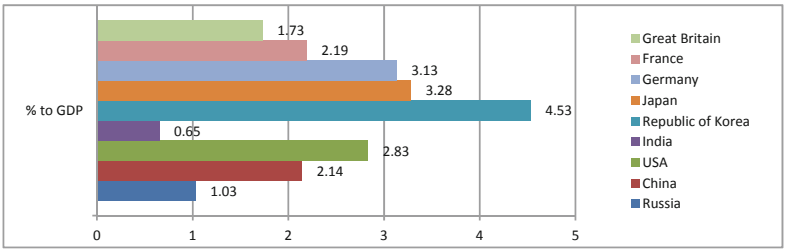

Fig. 5. Internal research and development costs, as a percentage of GDP, 2019.

and for the position of Russia on the world stage [9]. From 2015 to 2019, a decrease in the number of patent applications received was at the point of 15.7%. Some positive dynamics are observed in terms of applications for industrial samples, in 2019 providing an increase of 140.3%. It should be noted that the activation of Russian applicants, the number of applications increased from 2015 to 3363 applications (Fig. 7). WIPO data for 2019 show that Russia in 2019 took 9th place in the international innovation space in terms of applications for brakes and utility models [10]. In first place is China - 1400661applications, in second place is the United States - 621453 applications. Japan closes the top three - 307969 applications. In terms of the activity of publishing mass and

educational literature, our country in 2019 took 2nd place in the world ranking (115,000 books), missing only Great Britain with a number of editions - 202,000 (Figs. 6 and 8).

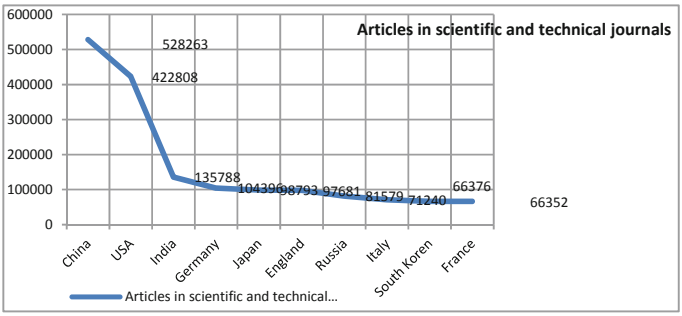

Fig. 6. Articles in scientific and technical journals, 2019.

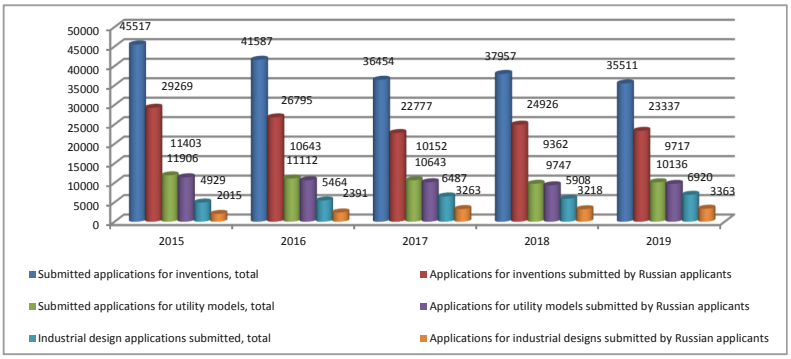

Fig. 7. Dynamics of received patent applications in Russia for 2015–2019.

The dynamics of the issued patents during the analyzed period indicates a deterioration of the situation [11]. In 2019, compared to 2015, the number of issued security documents decreased by 2% (Fig. 8). The number of patents issued to Russian applicants decreased from 2015 to 2019. by almost 5%. The numbers witness a decrease in patent activity of both residents and non-residents [12].

Statistics show that China, the USA and Japan are leading in the number of patents issued. For comparison, in China in 2019 452,804 patents were issued, in the United States - 333,530 pieces, which is 15% more than in 2018.

Among the reasons for the low inventive activity of residents were the following: an insufficient number of highly qualified specialists in the field of intellectual property; insufficient financial support for research and development; lack of a systematic approach to intellectual property management; weak scientific and technical base of R&D. The reduction in the number of non-residents is caused, according to the author, by a geopolitical situation, accompanied by an aggravation of the confrontation between foreign countries in relation to Russia, the result of which is a decrease in the interest of dawn inventors in patenting their inventions in Russia [13].

In order to stimulate inventive activity in Russia, such a measure as a reduction in income tax for patent-holding companies introducing technological innovations was actively considered. In 2020, Rospatent optimized the timing of consideration of applications for intellectual property. Thus, the time of consideration of applications for inventions was 4.07 months versus 5,69 months in 2019, on a utility model - 1.11 versus 1,35 months, for industrial samples, the review period was reduced from 4.4 to 4,3 months. At the beginning of 2021, the provisions of the Civil Code of the Russian Federation entered into force, and the provision of three-dimensional models in applications for intellectual property were made.

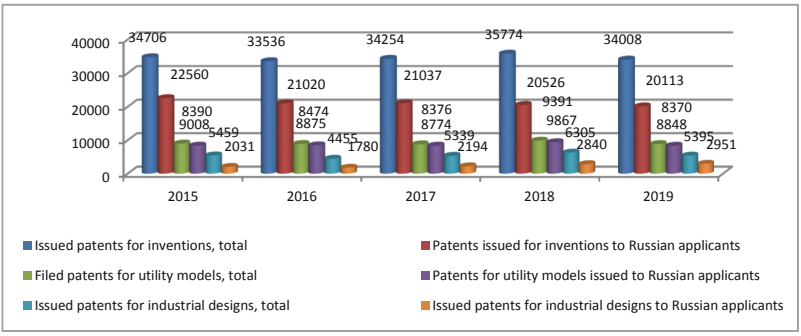

Fig. 8. Dynamics of issued patents in Russia for 2015–2019.

The level of innovative activity of Russian organizations during the analysis period decreased from 9.3 to 9.1% (Fig. 9). By industry affiliation, the numbers are as follows: the manufacturing sector - 20.5%; industry - 15.1 per cent; telecommunications and information technology - 9.8%; health and social services - 5.3 per cent; agriculture - 4.2%; construction - 3.7%; transportation and storage - 2.8%.

Negative changes can be seen in the value of innovative goods in the total volume of goods shipped. The indicator decreased by 3.1% in 2019 compared to 2015. Innovation costs, although they have positive dynamics in monetary terms, amounted to 1954.1 billion rubles in 2019, but the share in the total volume of goods shipped over 5 years decreased from 2.6 to 2.1% in 2019. The share of the intensity of costs for high-tech goods in 2019 in Russia amounted to 6.2% of the total cost of innovative activities [14].

In 2019 the situation with the export of high-tech goods was the following (in US dollars): China - 715 843 469 845, Hong Kong - 322 038 776 661, Germany - 208 677 809 287, USA - 156 074 126 641, South Korea - 153 561 173 548, Singapore - 150 958 791 008, France - 120 896 951 796, Japan - 104 042 048 408, Vietnam - 90 436 077 041, Holland - 87 120 587 840, Russia - 10 864 829 654. Russia in this ranking in 2019 was in the 29th place. The share of imports of high-tech goods for 2015–2019 in total increased from 58.7 to 66.9%.

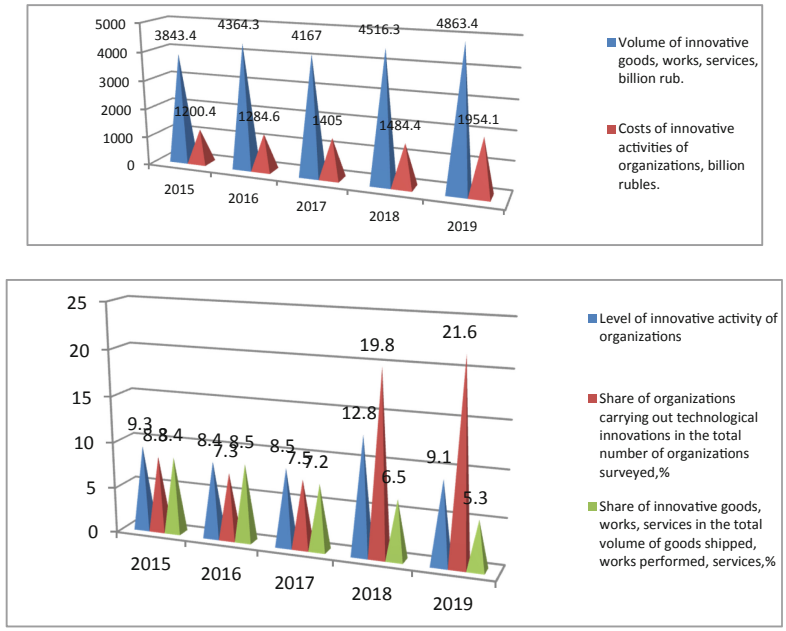

Fig. 9. Main indicators of innovative activity of Russian organizations for 2015–2019.

5 Conclusions

For Russia, one of the main problems associated with increasing innovation potential, according to the author, was the problem of commercialization of innovation. Statistics show the country's focus on maintaining science without taking into account real demand [15].

An overwhelming number of innovations constitute scientific novelty, neglecting the practical component and demand in the market. There was not enough high-tech facilities with modern equipment. As for 2019, due to fixed assets of industrial enterprises in Russia, it amounted to 50.7%.

Also among the obstacles to the growth of innovation capacity is insufficient investment in innovation by the private sector. The need to establish a State structure for the commercialization of patents was a necessary element in enhancing innovation. Despite the growth of the development institutions and foundations (for example, Skolkovo), there was a lack of a systemic approach with comprehensive State support and management of the promotion and commercialization of intellectual results.

References

1. Bessonova, E.A., Skotnikova, N.S., Golovin, A.A., Battalov, R.M.: Cooperation as a way to increase the efficiency of innovative development studies in systems. Decis. Control **316**, 99–107 (2021). https://doi.org/10.1007/978-3-030-57831-2_11

2. Grachev, I.D., Nekrasov, S.A.: Relying on the national innovation system as a necessary condition to implement national projects. Her. Russ. Acad. Sci. **90**(4), 406–416 (2020). https://doi.org/10.1134/S1019331620040097
3. Morkovkin, D., et al.: Assessment of innovation activity in the countries of the world. E3S Web of Conferences, vol. 157, p. 04015 (2020). https://doi.org/10.1051/e3sconf/202015704015
4. Peshkhoev, I.M., et al.: The methods of evaluation of investment project with undetermined parameters. Adv. Int. Syst. Commun. **726**, 64–71 (2019). https://doi.org/10.1007/978-3-319-90835-9_8
5. Lin, J.-Y.: What affects new venture firm's innovation more in corporate venture capital? Eur. Manag. J. **38**(4), 646–660 (2020). https://doi.org/10.1016/j.emj.2020.01.004
6. Kokand, F.M., Kokand, R.T., Kokand, D.M.: Trends in solving problems in the development of an innovative economy. J. Adv. Res. Dyn. Control Syst. **12**(6), 1205–1209 (2020). https://doi.org/10.5373/JARDCS/V12I6/S20201160
7. Zhukova, T., et al.: Peculiarities and development factors of modern agricultural engineering. E3S Web of Conference, vol. 175, p. 05028 (2020). https://doi.org/10.1051/e3sconf/202017505028
8. Avlasenko, I., Avlasenko, L., Peshkhoev, I., Podkolzin, Y., Savelyeva, O.: Enterprise growth simulation model. E3S Web of Conferences, vol. 175, p. 12006 (2020)
9. Alukhanyan, A., Osadchaya, N., Panfilova, O.: Research of management subsystems for the development of organizational capital of management companies. E3S Web of Conferences, vol. 175, p. 13006 (2020). https://doi.org/10.1051/e3sconf/202017513006
10. Kurdyukov, V., Kanurny, S.: Conditions for the effective functioning of the system of internalization of economic damage from emissions in the territory. E3S Web of Conferences, vol. 210, p. 13005 (2020). https://doi.org/10.1051/e3sconf/202021013005
11. Rumyantseva, A., Bichurina, V.: Special aspects of technological entrepreneurship financing at the present stage. MATEC Web of Conferences, vol. 170, p. 01084 (2018)
12. Karieva, E., Akhmetshina, L., Fokina, O.: Factors and conditions for the development of the digital economy in Russia. E3S Web of Conferences, vol. 244, p. 10025 (2021). https://doi.org/10.1051/e3sconf/202124410025
13. Sergeevna, B.L., Yurievna, N.O.: Sources and sociology concerns of financing the innovation activities in Russia. Int. J. Criminol. Sociol. **10**, 479–485 (2021)
14. Zaytsev, A., Talerchik, S., Dmitriev, N.: Evaluating rental factors of innovation sustainability in Russian regions using index methods. Montenegrin J. Econ. **17**(2), 93–103 (2021). https://doi.org/10.14254/1800-5845/2021.17-2.8
15. Khan, M.Z., Khan, Z.U., Hameed, A., Zada, S.S.: On the upside or flipside: where is venture capital positioned in the era of digital disruptions? Technol. Soc. **65**, 101555 (2021)