European Proceedings of
Social and Behavioural Sciences
EpSBS

www.europeanproceedings.com
e-ISSN: 2357-1330

DOI: 10.15405/epsbs.2021.04.02.210

GCPMED 2020
Global Challenges and Prospects of the Modern Economic Development

IMPACT ANALYSIS AND PROSPECTS FOR INNOVATION DEVELOPMENT IN RUSSIA

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Abstract

This paper discusses the issues of statistical assessment of innovation activity in the Russian Federation. The relevance of the topic is validated by the “Strategy of scientific and technological development” adopted by the Government of the Russian Federation for the period up to 2025. Moreover, this study is in line with the expansion of state support programs for innovative entrepreneurship. It is aimed at generating a quantitative assessment of innovation processes in Russia. Methods of time series analysis, extrapolation, and correlation and regression analysis were used. Statistics from the international organizations indicate that Russia is lagging behind the leading countries in terms of key innovation indicators. The reasons for this gap lie both in the overall organization of state support for the innovation sector and in the stagnation of innovation activity after the 2014-2015 crisis. The relationship between business and innovation activity, as well as the cyclical nature of the economy, suggest a possible change in the development vector towards growth. This is confirmed by the results of statistical forecasting. At the same time, there is an area in which Russia is in line with the leading countries. The matching of the growth trend in domestic and total research and development expenditures is observed. Thus, there is reason to expect a positive effect from the implementation of the the “Strategy of scientific and technological development of the Russian Federation”.

Keywords: Dynamics, economy, factor, forecast, innovation

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1. Introduction

Capacity to innovate plays a key role in the development of the modern economy. Unfortunately, statistics indicate a rather low level of innovation development in Russia. Among the reasons for this, the lack of professional competencies in science and experience in the competent organization of the production process can be noted. Due to the feeble interest from the government towards the expansion and implementation of innovations and research and development (R&D), there is still no established legal framework in the country that can regulate and resolve issues that define the foundations and stimulate society to develop and implement essentially vital innovations. There is a federal law draft “On innovation activities in the Russian Federation”, which has not yet entered into force. The Russian government controls the activities of state customers insufficiently. Thereby proper implementation of market mechanisms for the development of science and innovation is not ensured, and only minimal attention is paid to the application of R&D results in practice. The results implementation is mainly funded from the federal budget. In the context of innovation expenditures, the share of budget funds does not exceed 5%. In this setting the role of statistical analysis of such phenomena as innovative potential and innovative activity increases. On the basis of relevant statistical data, a quantitative analysis can be carried out. The results of this analysis can shed the light on the factors that influence innovation activity in Russia. Additionally, the prospects for innovative development of the country will be explored.

2. Problem Statement

Currently, there are three subsystems of state support for innovative entrepreneurship in Russia:

- project-targeted block;
- organizational and legal block;
- support block.

It should be noted, while assessing the support mechanism, that the state lays the groundwork for this mechanism in the “Strategy for scientific and technological development of the Russian Federation” (until 2025). In accordance with this Strategy, many options for long-term scientific and technological development have been developed. Russia's positioning in the system of international scientific and technological cooperation, which is based on the development of the national innovation system, has been determined. In scientific research, the main system-management aspects of the state support mechanism has been considered both from the position of the "triple helix" model (Mikhelashvili, 2016) and from the position of system analysis (Sukhenko, 2019).

However, this strategic document was adopted in 2016, and the analysis and forecasts made in it no longer reflect changes in the socio-economic situation. Therefore, the need for a statistical analysis of the current innovative development of the country and regions with the calculation of promising indicators is urgent. A review of the literature has shown that the analysis of innovation processes at the macro- and meso- levels by statistical methods has been carried out by a limited number of researchers. In general, statistical methods are complementary to methods of strategic management or a systematic approach. They can be divided into 3 groups.

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Time series analysis and forecasting methods dominate. The examples can be found in the works on assessing the innovative development of Russia (Khasanshin & Tokarev, 2017; Sharibzhanova & Tokarev, 2018), Belarus (Bliznyuck, 2020) and Poland (Khomenko & Mazurkevich, 2020).

A vast amount of research consists of statistical studies of the factors of innovation development in countries around the world. Specifically, the analysis of the impact of such factors as the state of the stock market in Southeast Asia (Nguyen et al., 2020), the reduction of the tax burden in China (Zheng & Zhang, 2020), economic policy in the European economic area (Maradana et al., 2019), and the development of entrepreneurship in small developing countries (for example, Ecuador) (de-Oliveira & Rodil-Marzábal, 2019) should be noted.

Finally, the third group of statistical methods includes various options for suggesting summarizing (complex) indicators that allow quantifying the innovative development of the territory. In Murashova (2020) two groups of indicators, namely: “innovation potential” and “innovation performance”, are developed. Hauser et al. (2018) offer three aggregate innovation indexes and six innovation indicators. Bianchini and Pellegrino (2019) suggested a synthetic indicator of innovation sustainability at the level of a firm with the prospect of scaling to higher levels of management.

For the state to be able to have the necessary information for rapid response and management decision-making, it is needed to analyze trends in innovation processes in the Russian economy. Statistical indicators that characterize the development of the innovation sphere can be considered as one of the most important components of the system for monitoring the development of modern society. Moreover, they allow monitoring the implementation of separate stages of the “Strategy of scientific and technological development of the Russian Federation”.

3. Research Questions

The research objectives were formulated based on the current attention to this issue. Firstly, the task is to determine the place of the Russian Federation in the world system of indicators of innovative development, and to compare the RF with the leading countries. Secondly, the analysis of factors of the state and dynamics of innovation activity in Russia is carried out. Thirdly, the short-term forecast of innovative indicators is made. The results of the study allowed drawing the conclusions about the prospects for the development of innovative activities in Russia. The nature of the phenomenon under study can be better understood through the application of the statistical approach. This study requires future consideration, and the list of its tasks can be expanded.

4. Purpose of the Study

The aim of the research is to form a quantitative assessment of innovation processes in Russia. The application of statistical methods is emphasized in this paper. The initial data for the study are the databases of the Federal State Statistics Service and the international organizations. The information was partially obtained from the database of a joint research by Rosstat and the Higher School of Economics. Namely, it was the evidence on international innovation statistics. This made it possible to compare the indicators for

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Russia with other countries. The results of the study can serve as a guide in assessing the degree of implementation of strategic documents for innovative development at the federal level.

5. Research Methods

The methodological and theoretical basis of the research is based on the studies of domestic and foreign experts on the statistical study of innovation processes in countries and regions. Traditional research methods were used in the work as a part of the statistical set. The method of summarizing indicators was used for the quantitative description of innovation activity. Comparison of data in time was performed by the method of time series analysis. Correlation and regression analysis was used to measure the relationship of innovation performance indicators with socio-economic factors. The visualization of the results was obtained by tabular and graphical methods of data representation. Forecasting was performed with the application of trend models. The initial data were processed using application software packages «Statistica 13.3» and «Microsoft Excel».

6. Findings

The main task Russia faces today is to increase the competitiveness of the economy. In the annual ranking of countries by the Global Competitiveness Index (GCI), which is compiled by the world economic forum, Russia remained in 43rd place among 141 countries by 2019. In total, since 2012, Russia's place in this rating has grown significantly. To increase the competitiveness of the Russian Federation, the state is constantly working on mechanisms aimed at stimulating businesses that can influence the improvement of the Global Competitiveness Index indicators. This index is based on information that is publicly available. It characterizes the country's innovation potential.

The greatest attention is paid to R&D activities that are focused on the formation of an innovative and active ecosystem and aimed at effective transformation of the economy. The volume of domestic R & D expenditures in Russia in 2018 amounted to 1.0% of GDP, making Russia one of the TOP 30 leading countries in terms of domestic research and development expenditures. But the negative point is that the gap from Israel, which is the leader (5.0%), is very large. The same gap is observed for another important statistical indicator, which is the innovation activity of organizations. Russia is surrounded by Eastern European countries and lags far behind the leading countries in this rating (Figure 1).

At the same time, the trend of R&D expenditures in the Russian Federation over the past two decades goes in line with the trends typical of the world's leading economies: while domestic R&D expenditures in Russia increased by 2.6 times in 1995-2016 (in constant prices), total R & D expenditures in the countries of the Organization for Economic Cooperation and Development (OECD) increased by 1.9 times. However, a number of countries, including fast-growing economies, show more impressive results, for example, China increased costs over the same period by 21.9 times (in constant prices), the Republic of Korea by 4.5 times, and Israel by 3.7 times.

This paper analyzes innovation activity in the Russian Federation in the regional context (meso-level) and at the state level (macro-level). In general, Russian regions are characterized by low volumes of innovative goods, works and services. There are several leading regions in terms of innovative products,

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expenditures on technological innovations, advanced technologies used, and other indicators that characterize innovation activity. The regions with the highest values of these indicators include the Moscow region, Moscow, Saint Petersburg, and the Republic of Tatarstan. For example, in terms of expenditures on technological innovations (as a percentage of total output), regional differentiation is very significant, specifically, the variation coefficient reaches 90.2%. At the same time, the average value of the indicator is 1.49%, and half of the regions have a value of less than 1.2 %.

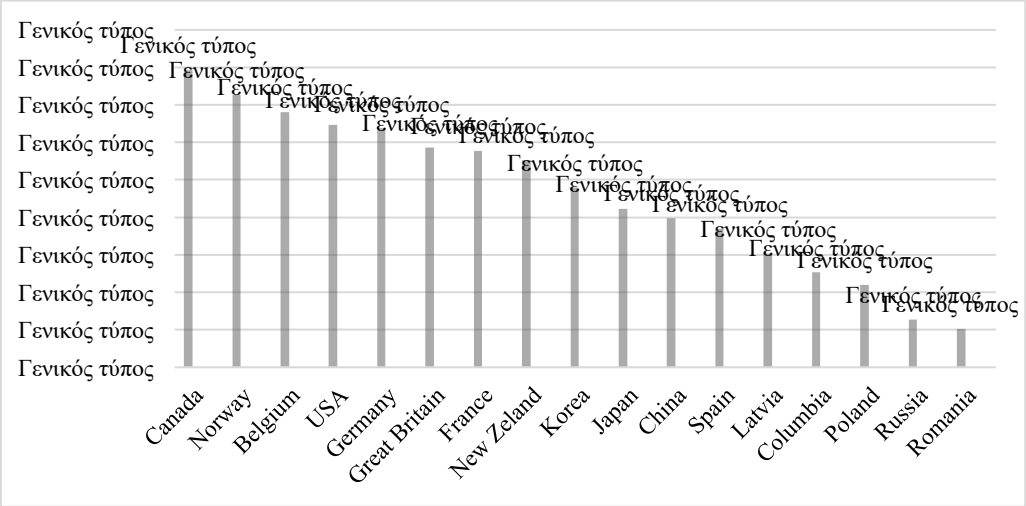

Figure 1. Country leaders in aggregate level of organization innovation activity in 2018 (%)
Source: authors based on (National Research University Higher School of Economics, 2020).

For regression analysis, a large number of factors can be identified that have a direct (stimulating) or reverse impact on the innovation activity of organizations and their output. Selecting these factors and measuring their impact represents the issue of special interest for this study.

The effective indicators in this research are as follows:

Y_1 – Innovative activity of organizations (the share of organizations that implemented technological, organizational, and marketing innovations in the reporting year, in the total number of organizations under study), %;

Y_2 – Share of innovative goods, works, and services in the total volume of goods shipped, works performed, and services provided (%).

As factor indicators, social, demographic, financial and general economic indicators were used. The sample was represented by 85 regions of the Russian Federation. As a result, two regression models were built. They mathematically reflect the relationships with the most important factors.

The model for the indicator "innovative activity of organizations" (Y_1) was:

$$\hat{Y}_1 = 0{,}28 + 0{,}08x,$$

where X is the share of organizations that used personal computers (%).

All regression coefficients are significant by the t-criterion at a 5% significance level. The economic background of this is that an increase in the share of organizations that used PCs by 1 percent leads to an increase in innovation activity by an average of 0.08 percent; therefore, there is a direct relationship between the activity of enterprises in the field of innovation and technical supportability.

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The value of the determination coefficient of in our model (0.504) shows that the variation in innovation activity of organizations by 50.4% is determined by the variation in the share of organizations that used personal computers, and by 49.6 % by the variation of other factors. The model for the indicator "share of innovative goods, works, and services" (Y_2) is represented by a multiple regression equation. To rank factors by the degree of influence, it was written in a standardized form:

$$\hat{Y}_2 = 0{,}683X_1 + 0{,}162X_2,$$

where X_1 is the application of advanced production technologies (units);

X_2 is the share of research and development expenditures in gross domestic product (GDP) (%).

Regression coefficients show that the most significant impact on the volume of innovative products is exerted by an increase in the number of advanced production technologies used. A multiple correlation coefficient of 0.78 indicates a strong relationship between the performance indicator and the set of factor indicators included in the model.

The coefficient of determination indicates that 60.9% of the variation in the volume of innovative goods, works, and services in the Russian Federation is due to the influence of the above-mentioned factors. The rest of the variation is due to other factors.

The dynamics of innovative goods, works, and services production in Russia is demonstrated in Table 1.

Table 1. The dynamics of innovative output in Russia

Years	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Share of innovative output, %	4,8	6,3	8,0	9,2	8,7	8,4	8,5	7,2	6,5	5,3
Rate of increment, % to 2010	---	31,3	66,7	91,7	81,3	75,0	77,1	50,0	35,4	10,4
Rate of increment, % to the previous year	---	31,3	27,0	15,0	-5,4	-3,4	1,2	-15,3	-9,7	-18,5
Value of innovative output, bln.rub.	1244	2107	2873	3508	3580	3843	4364	4167	4516	4863
Rate of increment, % to 2010	---	69,4	131,0	182,0	187,8	209,0	250,9	235,0	263,1	291,0
Rate of increment, % to the previous year	---	69,4	36,4	22,1	2,1	7,4	13,6	-4,5	8,4	7,7

Source: authors.

The peak of innovation activity of Russian organizations occurred in 2011-2013, when on average every tenth ruble of products shipped was the result of innovation. Russian enterprises invested in various types of innovations (technological, organizational, etc.). Then there was a period of decline. In 2014-2015, due to anti-Russian sanctions, business activity in the business sector decreased. This was the reason for the increased attention of the state to innovations. A number of strategic documents have been developed, and many enterprises have received financial support. There are reasons to change the general vector of development towards growth.

The indicator of the value of innovative output strongly correlates with inflation, so the general conclusions about its dynamics are not made in this paper. To be more objective the share of innovative

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product should be considered. It is the object of forecasting for the medium term. 2025 was set as the forecasting horizon. This year is the final year for the "Strategy of scientific and technological development of the Russian Federation". For forecasting, a longer time series-from 2003 was chosen.

The dynamics of the share of innovative goods, works, and services in Russia can be mathematically represented by the trend equation in the form of a polynomial function:

$$\hat{Y} = 4{,}96 - 0{,}39t + 0{,}06t^2 - 0{,}001t^3.$$

The quality of this model is confirmed by the high coefficient of determination of 0.831. Thus, 83.1% of changes in the share of innovative output are explained by the time factor. Based on this model, a point forecast for 2020-2025 for the country as a whole was made. The forecast values are determined as follows: 10.99 % in 2020, 11.40 % in 2021, 11.77 % in 2022, 12.09 % in 2023, 12.35 % in 2024, and 12.54 % in 2025. Thus, the indicators of innovation activity in Russia were closely related to economic dynamics. After the crisis period, gradual growth is expected, which should have a positive impact on the implementation of the "Strategy for scientific and technological development of the Russian Federation".

7. Conclusion

Russia is behind most of the countries in terms of innovation activity. Thus, the following conclusions can be drawn:

- the state innovation policy for entrepreneurship is not completely determined, it is still fragmented and unstable;

- the organizational and legal mechanism for supporting innovative entrepreneurship has a number of drawbacks, especially in terms of regulatory support for the functioning and development of innovative activities, which prevents the formation of a favorable climate for effective innovation in Russia;

- the financial and resource mechanism of state support requires a systematic approach to solving urgent problems.

The innovation activity in the country is a reflection of the ongoing socio-economic processes. The decline in business activity in the economy affects the decline in innovation activity. Thus, the cyclical nature of these processes indicates an upcoming change in the trend.

The state strives to meet the challenges of the time. The development of the "Strategy for scientific and technological development of the Russian Federation" is a powerful tool for stimulating innovation processes, starting from the micro level.

The statistical analysis conducted in this paper is only the first part of a comprehensive study of the entrepreneurial activity of the Russian economy, which involves studying not only the territorial differences of the corresponding indicators, but also measuring their relationship with other phenomena, modeling and forecasting. Statistics should in practice become a tool for justifying science and technology policy. It should quickly respond to policy priorities and not just reflect current trends. Its mission is to anticipate possible trend changes in the future.

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