

Upgrade of Russian Industrial Corporations in The Conditions of Establishing a National Innovation Ecosystem



Sergey Ivanovich Dovguchits, Artur Dmitrievich Bobryshev, Vladimir Rafailovich Vesnin, Marina Alekseevna Izmailova, Andrey Yurievich Moshin

Abstract: The article presents comparative analysis results for the state of the business environment for innovation transformations in the Russian economy by comparing Russia's positions with those held by world powers in leading international ratings that characterize conditions for economic growth and quality of economic growth. The article shows data pointing to positive changes in the country's competitiveness and its critical lag in terms of global leadership in high-tech markets and labor productivity. In the article, the authors assess the condition and development trends in the national innovation ecosystem, with close attention paid to the analysis of interaction among major venture market participants, the discovery of factors, which encourage and prevent its development. The authors emphasize that major industrial groups are introverts when executing domestic technology projects and ignoring their opportunities of breaking onto the venture market. The authors accept arguments in favor of choosing major industrial enterprises as targets of innovation policy as producers of faster and more tangible innovation results. They substantiate whether the development of Russian industrial enterprises under the Industrie 4.0 model is adequate, describe tools, measures and the best practices to bring innovations to the industrial sector. They draw a conclusion that the Russian industrial sector's innovation development is possible and urgent as a factor of solidifying the country's economic strength.

Keywords: Innovation, National Innovation Ecosystem, Industry, Innovation Development, Industrie 4.0.

I. INTRODUCTION

Russia faces an acute problem of creating competitive industrial enterprises, distinctive features of which should be mass application of breakthrough industrial technologies,

readiness and ability to integrate into the global technology environment; generation of innovative ideas, development and application of advanced industrial technologies, including digital ones; commitment to conquering new innovation product markets; intellectualization and ecologization of all business processes. Sustainable trends of innovative development, which cover all sectors of the national economy, also inevitably enter the industrial sector that is traditionally considered conservative when it comes to the application of innovative solutions. At the same time, a large-scale digital revolution with global outreach and the establishment of Industrie 4.0, which constitutes a wide range of innovative methods, can suppress the stable resistance of Russian industrial enterprises to transformations.

The purpose of the article is to conduct a comparative analysis of conditions for innovation transformations in the Russian economy, of the state and development of its national ecosystem, and to find promising ways of industrial transformation in the Industrie 4.0 model. This study is topical because scientists have paid little attention to the issues related to the compliance of the innovation ecosystem with expectations of its key participants and to identifying its appeal for investors in the conditions of an emerging new technological revolution, constantly changing economic environment, challenges of which are quite painful for Russian industrial enterprises, and all this requires new research.

II. METHODS

The study was based on the generalization of well-known approaches pursued by foreign and Russian scientists whose papers touch upon problems of innovation development, the transformation of operations at industrial concerns in the conditions of a new technological revolution and development of digital technologies. The study is based on the papers compiled by foreign (I. Arroniz, D. Ennis, S. Mendell, M. Sawhney, R.C. Wolcott and others) and Russian (N.D. Avarskii, M.Y. Veselovsky, A.E. Gorokhova, I.A. Merkulina, V.D. Sekerin, A.V. Sharkova and others) scientists, and on the results of empiric research conducted by economists from the Russian Ministry of Economic Development (National Report on Innovations in Russia – 2016 and National Report on Innovations in Russia – 2017), international monitoring data (Global Innovation Index 2017,

Manuscript published on 30 September 2019

* Correspondence Author

Sergey Ivanovich Dovguchits*, All-Russian Scientific Research Institute «Center», Moscow, Russia.

Artur Dmitrievich Bobryshev, All-Russian Scientific Research Institute «Center», Moscow, Russia.

Vladimir Rafailovich Vesnin, All-Russian Scientific Research Institute «Center», Moscow, Russia.

Marina Alekseevna Izmailova, Federal State-Funded Educational Institution of Higher Education "Financial University under the Government of the Russian Federation", Moscow, Russia.

Andrey Yurievich Moshin, All-Russian Scientific Research Institute «Center», Moscow, Russia.

© The Authors. Published by Blue Eyes Intelligence Engineering and Sciences Publication (BEIESP). This is an [open access](https://creativecommons.org/licenses/by-nc-nd/4.0/) article under the CC-BY-NC-ND license <http://creativecommons.org/licenses/by-nc-nd/4.0/>

Global Competitiveness Index 2016-2017, Doing Business 2017) and statistical data from the Federal State Statistics Service [1]. The study’s results were formalized and generalized by applying general scientific cognitive methods (the dialectical method, the method of analogy, analysis and synthesis), and by applying special methods of empiric knowledge (methods of scientific modeling, analysis of economic statistical indicators, comparative analysis and expert estimates).

III. RESULTS

A. Russia’s positions on the global innovation map

The effectiveness of measures taken by the Russian government to promote the country’s breakthrough innovation development is most accurately seen in positive changes in Russia’s positions in leading international ratings which characterize economic growth conditions [2] and quality of economic growth [3] (Figure 1).



Fig. 1. Changes in Russia’s places in international ratings

Figure 1 data show that both in the short term and the long term Russia took the biggest leap in the creation of favorable conditions for doing business. Specifically, in the Doing Business rating [4], Russia advanced by 85 points from 120th in 2010 to 35th in 2017. Meanwhile, Russia’s position has improved by 16 points in the past twelve months (2016-2017). The effectiveness of measures taken by the government to provide business conditions for all types of companies in Russia is currently comparable with such countries as the Netherlands (32nd), Switzerland (33rd), Japan (34th) and Slovenia (37th).

Russia also improved its global competitiveness positions, having advanced during eight years (2010-2017) in the Global Competitiveness Index rating from 63rd in 2010 to 38th in 2017. Over a 50% increase in the country’s positions was largely driven by impressive growth in such blocks as Quality of Institutions (+35), Effectiveness of the Goods and Services Market (+43), and Competitiveness of Businesses (+30), which have traditionally been the weakest components of aggregate assessment of the country’s global competitiveness since 2010. Russia also improved in the long term and retained in the short term its relatively strong positions in such blocks as Infrastructure (+12 in 2010 vs. 0 in 2016), Higher Education and Professional Training (+18; 0), and the Size of the Domestic Market (+2; 0). Separately, it should be noted that over the past twelve months Russia has delivered impressive growth in such indicator as

Macroeconomic Stability (+38). Based on the innovation potential estimate, Russian remains above the average, being ranked 49th among 137 countries. As for the international estimate of its global competitiveness, Russia’s position is close to such countries as Spain (34th), Malta (37th), Poland (39th), and India (40th).

During the period under analysis Russia advanced by 19 points in the Global Innovation Index, taking 43rd place in 2016. Strong positions are still driven by improvements in the Innovation Input Sub-Index that characterizes available resources and conditions for innovation. In the Institutions block, Russia advanced by 44 from 117th in 2010 to 73rd in 2017. As regards the Domestic Market Development block, the country ranks 60th (+37), and its positions in the Business Development block climbed by 62. As for the Innovation Output Sub-Index that characterizes practical results achieved in innovation, in the long term Russia’s position remained intact (51st in 2010 and 2017), and lost 4 points in the short term from 47th in 2016 to 51st in 2017.

Overall, from 2010 through 2017 changes in Russia’s positions in most Global Innovation Index blocks were fluctuant, which characterizes the country’s position on the global innovation map as unstable.

Currently, international experts assess Russia's innovative development at a level of such countries as Greece (44th place in the Global Innovation Index), Romania (42nd), Turkey (43rd) and Chile (46th). Russia still lags behind leading EU innovative economies (the UK (5th), Germany (9th), Denmark (6th), Ireland (10th), the Netherlands (3rd), Finland (8th), and Sweden (2nd)), OECD member states (the USA (4th), Switzerland (1st), and Japan (9th)). As regards BRICS, Russia is behind China (22nd). Apart from ratings, innovative development results are characterized by the following indicators: a country's share in global high-tech goods exports (global leadership on high-tech markets) and the ratio between gross added value and the annual average employment rate (labor productivity). By both indicators, Russia substantially lags behind most EU and OECD member states [1].

B. Assessing the condition and development trends in Russia's innovation ecosystem

Analyzing Russia's innovation ecosystem that is shaping up [5], the authors will focus their attention, above all, on the venture market ecosystem, its important component that is critical for the successful implementation of innovative solutions, and this ecosystem implies the following:

- a system of relations between technology entrepreneurs and investors, their motivation for interaction with one another, views about factors of business success and the "rules of the game" on the venture market [6];
- a system of objects in venture market infrastructure that is designed to activate, harmonize, increase stability, transparency and economic effectiveness of this interaction;
- the impact of state and quasi-state institutions on the effectiveness of interaction among key market participants.

The general mechanism of assessing the condition of the Russian venture market's ecosystem [7] between investors and technology entrepreneurs has matched in the past 5 years. However, it should be noted that the consensus is higher among investors compared with entrepreneurs, with more respondents pointing to positive changes in the venture market. Investors are more optimistic about domestic parameters of market development, more often (by 1.5 times) mentioning an increase in the number of projects that are potentially attractive for investment; more often than technology entrepreneurs, they believe that grants and government financial support of innovation activities have become more available. Meanwhile, opposed to startups, they more often are sure that the venture market's external indicators deteriorated, with fewer opportunities to draw foreign investment, while the appeal of technology entrepreneurship within Russia's economic structure, at least, has not improved.

While analyzing hurdles that prevent the venture market from growing [8], the authors pointed out that the biggest hurdles, as investors think, are a limited number of startups which are attractive for investment (65%), the lack of entrepreneur competence of the public (62%), a short planning horizon (58%), and non-professionalism of technology entrepreneurs (52%). Startups, in turn, believe that business development is hampered by such factors as weak demand for innovation (54%), competition on the

global market (39%), restrictions of standardization and economic barriers of the global market (29%), and insufficient measures of government financial support (36%).

The standard procedure for foreign investors to diversify their portfolios by adding high-risk Russian assets is not attractive because it is not possible to assess aggregate risks associated with investment in startups [9]. As a result, major industrial corporations that might become industry leaders and strategic investors do not enter the venture market, but prefer to develop technology projects at their own facilities or in other jurisdictions [10]. All this cuts the number of domestic sources of capital. So, the study's results show that until now the Russian venture market has been poorly structured and vague for its agents.

C. Roads of innovation development for Russian industrial enterprises in the Industrie 4.0 model

The conducted analysis puts an acute question of what innovation policy should focus on to transform headway made in the past few years to improve innovation environment into higher innovation activities. As research showed [11], the focus solely on the academic environment, venture investment and startup companies does not make it possible to achieve results fast. As a matter of fact, this leaves two options to take efforts (individual inventors and mature business).

Needless to say, breakthrough ideas help individual inventors form a base that underlies further commercialization [12]. However, the authors think that aggressive stimulus for innovation activities at mature businesses, primarily, major industrial concerns, is the most promising option to garner the most important results [13]. Nowadays, it is mature businesses, which account for the bulk of the economy, that are the most outdated because in Russia mature businesses account for just 33% of total patents (95% in Germany). This fact points to the enormous potential of technology transformation at major enterprises that constitute a big portion of the national economy (Figure 2). Encouraging major businesses to generate innovation processes at their facilities, opportunities arise to expand the scope of innovation activities by 80% of the economy (Figure 3), and this is a compelling argument in favor of innovation stimulus at major businesses.

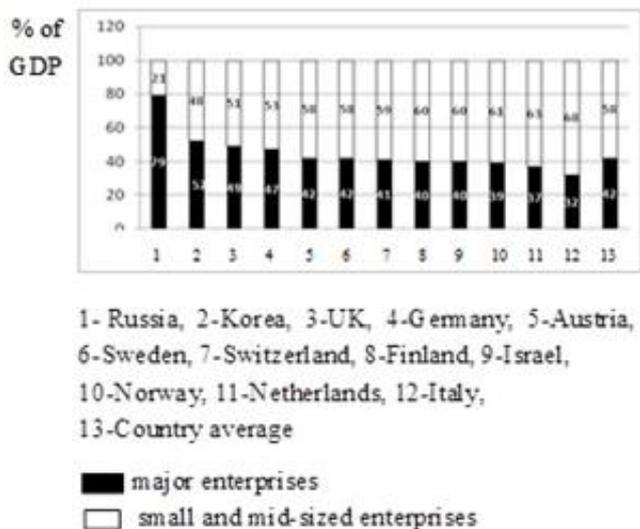


Fig. 2. Contribution made by small, mid-sized and major businesses to GBP in Russia and developed economies, %

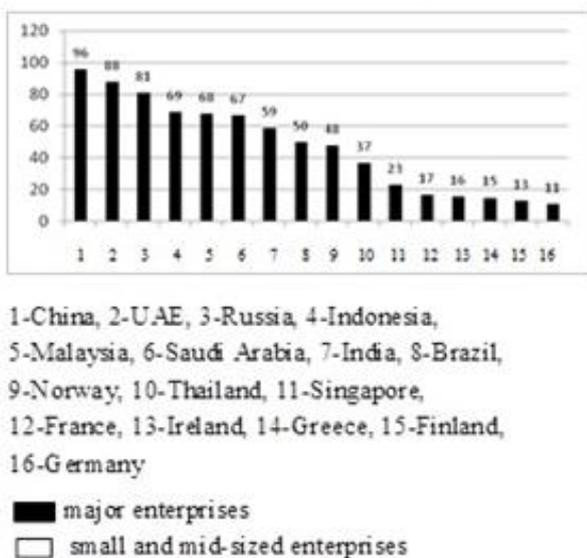


Fig. 3. Government stakes in ten biggest companies in various countries, %

The most promising idea of making Russian industrial enterprises more innovative is development under the Industrie 4.0 model, which offers a wide range of innovation development methods (big data analysis, augmented and virtual reality, 3D modeling, robotics, machine learning, machine vision, industrial Internet of things, 3D printing, and unmanned aircraft vehicles). The application of the current Industrie 4.0 tools will prompt enterprises to develop at their facilities industrial Internet of things, which unites a set of required software solutions and to introduce new types of equipment. The potential annual effect from the introduction of the industrial Internet of things on industrial and construction sites is valued at USD 1.4 trillion to USD 4.6 trillion. The effect from the introduction of other Industrie 4.0 elements has not yet been subject to reliable assessment [14], but it is evident that they will increase the positive impact on industrial enterprises.

The most promising measures that need to be taken for value creation by introducing Industrie 4.0 technologies at production facilities are to optimize operating conditions and equipment utilization, to improve labor productivity and safety, to optimize logistics, to improve the quality of

products, to minimize time to bring products to the market, to increase accuracy of demand forecasting and the quality of after-sales service [15]. For capital-intensive industrial enterprises (oil and gas production, power generation) Industrie 4.0 technologies open new opportunities for substantial efficiency growth but do not entail any radical transformation of a business model [16]. For more capital-intensive industries the optimization potential means the higher efficiency of operations via automation, the application of sensors connected to the industrial Internet of things and in-depth analytical data. The introduction of digital technologies can also yield considerable results in the manufacturing sector due to its high labor intensity [17]. Efficiency can grow at all stages of the value chain ranging from faster development and promotion of new products to the market, connecting production and component delivery chains to the much better efficiency of planning, production, quality control and the service level of end products. Upgrade of the Russian machine engineering sector based on Industrie 4.0 principles [18] can substantially increase labor productivity in this sector as labor productivity is considerably lower compared with countries with developed industrial sectors [19]. It is possible to eliminate the Russian industrial sector’s digital lagging from industrially developed countries [20] by upgrading Russian enterprises at several levels such as (1) technologization of industrial equipment, (2) development of an IT system and (3) digitalization of business processes.

IV. DISCUSSION

The current resistance of industrial enterprises to innovation poses a big risk, impairing the whole country’s competitiveness. Inactivity on the innovation front inevitably affects production efficiency and, on a global scale, pushes a country out of the mainstream of innovation and technological development. For this reason, it is necessary to form a system for strategic management of a national innovation ecosystem, to find domestic sources and alternative tools for innovation development, to explore all chances for technological breakthroughs, to produce and take innovation to a new level.

V. CONCLUSION

The Russian venture market has not yet grabbed a big stake in its class of assets in private investment portfolios for a number of reasons (major participants have weak motivation to execute their investment strategies; there are no tools required to support startup growth and startups leave the country after early stages; an institutional problem related to disorder in legal support of startup departures, insufficient activity of corporations, direct investment funds and other institutional investors. The large-scale application of tools, which make up the Industrie 4.0 model, above all by industrial leaders can turn enterprises themselves into a key factor of fast and tangible results in the promotion of innovation, solidify positive trends in the country’s innovation development, and make the Russian economy a leader in the world’s innovation technological development.



REFERENCES

1. Rosstat. Russia in Figures. Brief statistical collection. Moscow, 2017.
2. World Economic Forum. The Global Competitiveness Report 2016–2017, 2016. Available: <https://www.weforum.org/reports/the-global-competitiveness-report-2016-2017-1>.
3. D. Soumitra, L. Bruno, S. Wunsch-Vincent, The Global Innovation Index 2017, 2017. Available: <http://www.wipo.int/edocs/pubdocs/en/wipopubgii2017.pdf>
4. Doing Business. Equal Opportunity for All (14th Edition), 2017. Available: <http://www.doingbusiness.org/>
5. A.E. Gorokhova, V.D. Sekerin, Growth of the Russian Industrial Companies Efficiency at Transformation of National Innovative System. The 10th International Days of Statistics and Economics, 494-503, 2016.
6. Y.V. Morozhuk, A.V. Sharkova, I.A. Merkulina, O.N. Vasilyeva, "Innovative aspects of development of the waste recycling industry in the new economic context: problems and prospects", *Journal of Environmental Management and Tourism*, 8(3(19)), 2017, pp. 507-515.
7. S.V. Serebryakova, National Report on Innovation in Russia, 2017. Moscow. Available: http://www.rvc.ru/upload/iblock/c64/RVK_innovation_2017.pdf
8. G. Westerman, D. Bonnet, A. McAfee, Leading Digital: Turning Technology into Business Transformation. Harvard Business Review Press, 2014.
9. G. Schuh, T. Potente, C. Wesch-Ponte, A.R. Weber, J.P. Prote, Collaboration Mechanisms to Increase Productivity in the Context of Industrie 4.0. *Procedia CIRP* 19, 2014, pp. 51-56.
10. T.I. Gulyayeva, T.M. Kuznetsova, J.V. Gnezdova, M.Y. Veselovsky, N.D. Avarskii, "Investing in Innovation Projects in Russia's Agrifood Complex", *Journal of Internet Banking and Commerce*, 21(S6), 2016, pp. 1-13.
11. M.Y. Veselovsky, N.S. Khoroshavina, O.A. Bank, A.E. Suglobov, S.A. Khmelev, "Characteristics of the Innovation Development of Russia's Industrial Enterprises under Conditions of Economic Sanctions", *Journal of Applied Economic Sciences*, 12(2(48)), 2017, pp. 321-331.
12. S. Mendell, D. Ennis, "Looking at Innovation Strategies", *Research Management*, 28(3), 1985, pp. 33.
13. M. Sawhney, R.C. Wolcott, I. Arroniz, "The 12 different ways for companies to innovate", *MIT Sloan Management Review*, 47(3), 2006, pp. 75-81.
14. E.V. Martynova, "Peculiarities of assessing a company's innovation development", *Bulletin of the Financial University* 2(86), 2015, pp. 61-69.
15. S.M. Dahlgaard-Park, "The quality movement: Where are you going", *Total Quality Management. Special Issue: The Best of Europe*, 23(5-6), 2011, pp. 453-516.
16. V.N. Knyagin, New technological revolution: Challenges and opportunities for Russia, an expert analytical report. Moscow: Center for Strategic Research, 2017.
17. CSR. Analysis of the most important structural characteristics of production facilities in the Russian manufacturing sector, 2017. Moscow. Available: https://www.csr.ru/wp-content/uploads/2017/01/Doklad_promyshlenny_e-moshhnosti.pdf
18. S. Glaziev, The Future Economy. Does Russia Have a Chance? Moscow: Publishing house Knizhny mir, 2017.
19. E.B. Kuznetsov, National Report on Innovation in Russia. Moscow, 2016. Available: http://www.rvc.ru/upload/RVK_innovation_2016_v.pdf
20. M. Hermann, T. Pentek, B. Otto, Design Principles for Industrie 4.0 Scenarios. The 49th Hawaii International Conference on System Sciences, 3928-3937, 2016.