

Methodology and Practical Aspects of Technological Development of Russia: High-tech Enterprises as a Response to Global Economic Challenges

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Abstract

The research reveals the methodological foundations of innovation and technological development of economic systems, the concept of a conceptual evidence base of high importance of the technological factor in ensuring sustainable growth of the economy. We research strategic guidelines and policy directions of leading countries and regions of the world in response to large challenges. The basis is the dominant role of fast-growing high-tech companies contributing to the growth of the national economy in modern conditions. The identification and evaluation of the development parameters of the "national champions" of the Russian Federation was made. Based on the study of the best world practices, proposals have been made to improve the support system for fast-growing high-tech companies in the industry.

INTRODUCTION

At present, the main determinants of economic development on a global scale are the nature of globalization processes and the level of competitiveness of countries. The latter, in turn, is largely determined to date by a highly differentiated and endogenously unbalanced nature of innovation and technological development.

Unfortunately, according to the level of innovative development, Russia lags far behind the developed powers. Domestic economy traditionally imports progressive technologies: according to data for January-May 2017, the share of high-tech goods in Russian exports was 9.3%, and in imports - 62.7% [1]. In recent years, there has also been a decline in patent activity, the number of innovatively active organizations and the actual production of high-tech industrial products. The presented statistics indicate a sufficiently high level of technological dependence of the country and the formation of prerequisites for increasing the technological gap.

Definitely this problem is realized at the federal level. The confirmation of this is the approval by the President and the Government of the Russian Federation, respectively, of the Strategy for Scientific and Technological Development of the Russian Federation [2] aimed at forming an effective system

for managing the science and innovation sector, as well as the long-term integrated program "National Technological Initiative" [3] aimed at ensuring the leadership of domestic companies in the world markets of high-tech products. In 2016, the Ministry of Economic Development of the Russian Federation launched the project "Support for Private High-Tech Leader Companies" on the basis of the rating of the rapidly developing companies of the high-tech sector "TechSuccess" [4]. However, despite the measures taken and the presence in the country of individual operational elements of the innovation system, technological "breakthrough" in Russia has not yet happened.

Thus, the relevance of the topic under consideration is due to: the strengthening of global technological operations; significant level of the level of innovation and technological development on the economic performance of economic systems; presence of territorial and sectorial disparities in the development parameters of technology companies-drivers; fragmentation of methodological developments and selected practical recommendations, ensuring the dynamic development of the high-tech sector of the Russian economy [5, 6, 7, etc.].

METHODOLOGICAL FOUNDATIONS OF TECHNOLOGICAL DEVELOPMENT OF ECONOMIC SYSTEMS

Issues of technological development of the economy are in the field of view of domestic and foreign scientists for more than one century. Even the founder of the innovative theory, J. Schumpeter, studying the factors of economic growth, noted the importance of technological innovation [8]. A sufficiently profound justification for the importance of scientific and technological progress in the development of economic systems is also borne out in the works of R. Solow.

Modern scientific presentation of the problems of technological development is based on the concept of the technical and economic paradigm developed by K. Perez, K. Freeman, J. Van Dain, and others. The concept of the technical and economic paradigm was first introduced by K. Peres and defined as a set of industrial, financial, institutional structures and the corresponding socio-political

infrastructure that originated on the basis of a "bundle" of basic technological innovations [10]. Investigating the issues of economic dynamics, the authors of the concept saw the main reason for the crisis state of the economy in the inadequacy of the institutional environment of the new technical and economic paradigm, and the overcoming of the crisis was associated with the formation of new engineering or managerial competences, methods of organizing production and its infrastructure support. Thus, the justification of the interconnection of technological, economic, social and political processes formed within the framework of the concept of the technical and economic paradigm seems to us to be thoroughly and thoroughly worked out, moreover, which has not lost its scientific and practical significance in modern conditions.

Certainly the most prominent representatives of the Russian scientific school of the corresponding direction are S. Glazyev, N. Kondratiev, D. Lvov, S. Menshikov, V. Mayevsky, O. Sukharev, etc. It should be noted that the representatives of the Marxist school have a significant influence on the development of Russian scientific thought and practical activities for the development and implementation of technological innovations. We believe that the results of their scientific research are unjustifiably missed by most researchers of this problem because of the excessive political commitment of the school representatives. Nevertheless, in the writings of K. Marks and F. Engels, the importance of innovations at various stages of social production was noted, and the continuous character of the processes of mastering new technology and technology, based on the continuity of the process of reproduction itself, was justified [11]. Subsequently, V.I. Lenin, discussing the ways of developing the productive forces, noted the importance of industrial progress on the basis of new technology. It was this idea that formed the basis of the most important task of Soviet society in the period 70-80 of the XX century, formulated as the acceleration of scientific and technological progress.

Among the modern studies of the problems of technological development of the economy, the concept of technological structures has acquired special popularity in Russia. S.Yu. Glazyev the founder of the corresponding scientific school defined the concept of the technological structure as "a group of technological sets connected with each other by the same type of technological chains and forming reproducible wholes" [12]. At the same time S.Yu. Glazyev connects the transition to a new technological order with the exhaustion of the possibilities of the previous one, emphasizing the process of capital flow taking place in this process. To a similar conclusion comes in his study and V.I. Maevsky [13], whose works represent the corresponding direction of modern macroeconomic theory. In the author's opinion, the most important impetus to economic development is the presence of competition between "macro-generations" - subsystems of the macro economy that form certain parts of the GNP. Thus, resources are redistributed from basic macro-generations to

new ones. Noting the controversy of certain provisions of the above theory, the head of the sector of institutional analysis of economic dynamics of the Institute of Economics of the Russian Academy of Sciences, O.S. Sukharev in his works justifies the proposition that "the transition to new technological opportunities may not require resources from the previous level of technological development. In any case, it is due to the expansion of the resource base, additional resources "[14]. We share this position O.S. Sukharev, whose development in the field of forming a methodology for technological development of the economy and modeling an innovative type of economic growth seems to be a significant achievement of the Russian scientific school.

Thus, it can be concluded that the basic theories of technological development of economic systems, in spite of their inherent controversy on certain aspects, combine the availability of convincing evidence of the importance of the technological factor in ensuring sustainable economic growth.

STRATEGIC ORIENTATIONS OF TECHNOLOGICAL DEVELOPMENT OF NATIONAL ECONOMIES IN CONDITIONS OF LARGE CHALLENGES

At the present stage of the development of the world economy, its distinctive feature is the activation of globalization processes. With the growth of transnational flows of goods and services, human and financial capital, the expansion of the scale of information and technological transfer, national economies are united in the search for the most adequate response to the so-called "big challenges" that the society will have to face in the medium and long term [15].

The systematization of the distinctive features of the policies of the leading countries and regions of the world with respect to the response to large challenges is presented in the table 1.

Table 1. Peculiarities of the policy of the leading countries and regions of the world regarding the response to "big challenges"

| Country | Position of the national (regional) policy response to major challenges |
|---------|---|
| USA | Orientation to world technological leadership and cyber security, wide implementation of measures in the framework of Internet policy, improvement of the patent system, facilitation of accelerated transfer and commercialization of technologies, development of digital infrastructure, use of innovative teaching technologies, etc. |
| EU | Orientation towards the development of intellectual potential, improving the conditions for research activities, increasing the volume |

| | |
|-------|---|
| | and modernizing the mechanisms of financial support for science, developing academic mobility, stimulating international research collaborations, etc. |
| Japan | Orientation towards sustainable socio-economic growth and development of the nation, creating conditions for ensuring security and improving the quality of life of citizens, stimulating the creation of intellectual property, developing a culture of scientific and technological activity, integrating and socializing scientific, technological and innovation policies |
| Korea | The priority of the creative economy, the development of the creative vision of economic development and the "spirit" of creativity in responding to great challenges, stimulating the increase in the level of innovation in the science and technology sector, the development of information and communication technologies, etc. |
| China | Ensuring the comprehensive support of priority research projects for the social and economic development of the nation, creating and providing conditions for the development of world-class scientific centers, staffing research activities (especially in the basic sciences), creating a favorable innovation |

| | |
|--------|---|
| | climate. |
| Canada | Orientation to the world leadership in the sphere of innovations, promotion of investment inflow and highly qualified researchers into priority areas of science and innovation development, stimulation of integration processes, academic and research mobility in the scientific and technical sphere, modernization of the management mechanisms of research organizations in order to increase the effectiveness of their activities |

The most significant challenges affecting the sphere of technological development in Russia are: the continuing dominance of the "raw material model" of the country's economy against the background of the global trend of increasing the role of human capital and innovative technologies; demographic changes, generating new problems for the world community in the social sphere and health; strengthening of anthropogenic pressures on the environment and associated environmental risks; an objective need to improve and search for new energy-efficient technologies; changes in the geopolitical situation and the accompanying national security problems, etc. [2]. The above threats require the implementation of an effective response from Russia, aimed at ensuring the technological independence and competitiveness of the country, as reflected in the Strategy for Scientific and Technological Development of the Russian Federation [2] (Figure 1).



Figure 1. Key directions of the state scientific and technological policy of Russia

Thus, the state policy of the scientific and technological development of each of the countries examined is oriented to overcoming the big challenges and has its own specifics, conditioned by the peculiarities of the model of the national economy, its structure, targets in the social, economic and political spheres.

TECHNOLOGICAL COMPANIES - DRIVERS OF ECONOMIC DEVELOPMENT OF THE RUSSIAN FEDERATION

The results of our previous studies show that of the best world practices of infrastructure and institutional support of innovative and technological development, in a great majority of countries - innovative leaders, a special role is assigned to the so-called "technology gazelles" (high-tech fast-growing companies), which are driving economic development of macro-level.

In order to popularize the most successful companies specializing in the production of technologically complex products and possessing a high potential of leadership in global markets, the rating of high-tech companies "Tech Success" is annually carried out in Russia. The rating evaluation is conducted by JSC "Russian Venture Company" in conjunction with the Association of Innovative Regions of Russia. The partners of the project are also PwC in Russia, JSC "SME Bank" and NRU "Higher School of Economics". Participation in the rating is open for companies that meet the

following qualification requirements: revenue - 120-30 000 million rubles; the average annual growth rate of revenue for the last 5 years - not less than 15-20%; the average share of R & D expenditures for the last 3 years is not less than 5%, for technological innovations - no less than 10%, the share of innovative products in revenue is at least 20-30% [4].

According to the results of the rating of 2016, TOP-15 companies by revenue, TOP-15 companies by growth rates, TOP-15 innovation companies and TOP-15 companies by export volume were identified. Currently, the national rating includes 220 companies whose success stories are intended for replication and serve as the basis for measures to improve the mechanism and instruments of state support for the high-tech sector of the Russian Federation. Industry priorities of companies of Russia's technological leaders are presented in Figure 2.

The presented results allow making a conclusion that the most part of technologically successful companies is concentrated in the field of mechanical engineering, electronics, instrument making, and production of industrial equipment. The revenues of these companies in 2015 amounted to 131,492 million rubles, the average annual growth rate (in the last 5 years), 24%, the share of R & D spending - 19%, the share of costs for technological innovation - 26% [4].

The key performance indicators of the companies that formed the TOP-100 rating of "TechSuccess" are reflected in Table 2.

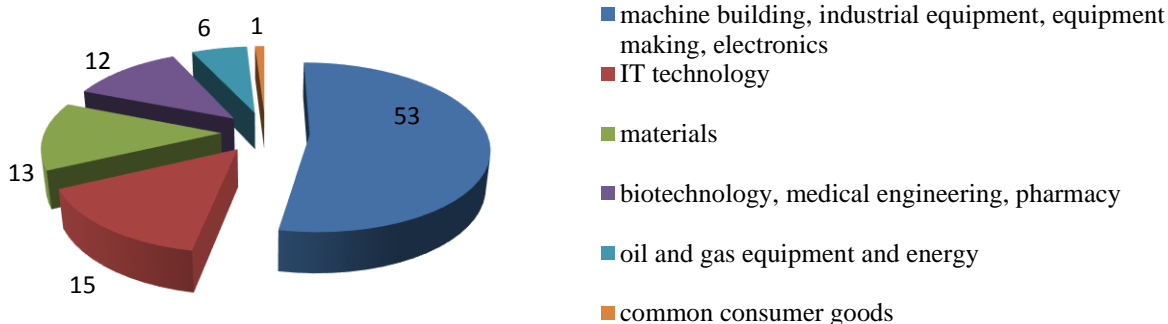


Figure 2. Industry priorities of companies of Russia's technological leaders according to the rating of "Tech Success" in 2016, the number of companies

Table 2: Key performance indicators of TOP-100 high-tech fast-growing companies in Russia (based on the results of the rating of "Tech Success-2016")

| Index | Meaning of index | | |
|--|------------------|------------------------|-----------------|
| | Big companies | Medium-sized companies | Small companies |
| Number of companies, units | 30 | 28 | 42 |
| Average number of employees, people. | 1541 | 488 | 121 |
| Average annual revenue, billion rubles. | 5,7 | 1,3 | 0,4 |
| The average annual revenue per employee, million rubles. | 3,7 | 2,8 | 3,1 |
| The average rate of revenue growth, % | 27 | 24 | 34 |

| | | | |
|---|----|----|----|
| Average age of the company, years | 30 | 23 | 16 |
| The share of R & D expenses in revenue, % | 16 | 12 | 19 |
| The share of costs for technological innovation in revenue, % | 23 | 26 | 25 |
| Share of new products in revenue, % | 53 | 53 | 64 |

It should be noted that the leaders of the rating are concentrated mainly in the Central Federal, Volga region and Northwest Federal Districts (46, 22 and 16 companies, respectively). The aggregate amount of revenues of these companies amounted to 222.3 billion rubles, the total number of employed - more than 64 thousand people. The absolute majority (67%) of the companies in question carried out export activity in the reporting period, the average share of exports in revenue was 20%. The total export volume of "national champions" in 2016 grew by 41%, and the fourth part of companies increased its value by half. The geography of export supplies is concentrated mainly in the territory of the countries of the former USSR, at the same time in 2016 the share of companies that exported to developed countries increased to 64% [4].

According to the results of the survey of representatives of companies TOP-100 rating "Tech Success" 2/3 of respondents express confidence in entering the number of world leaders in the target market within the next 5 years. At the same time, the key success factors are: obtaining an appropriate order from a Russian or foreign organization, attracting highly qualified specialists, and obtaining a state order for the implementation of research and development.

Most of the companies surveyed are characterized by a high level of innovative activity, performing R & D on a permanent basis. The result of this activity is the annual launch of innovative products on the market (more than 63% of business units are noted). Drivers of technological development of the economy at the current stage of the respondents recognize such industries as digital design and modeling, robotics, additive technologies, etc.

The main source of development of Russia's fast growing technology business was its own funds. At the same time, more than 77% of the companies surveyed to some extent used credit resources, 24% - funds of strategic investors, 9% - venture capital. The predominant part of the survey participants is considering the possibility of using the mechanism of state support in the future (mainly as an auxiliary tool). At the same time, the most popular forms of state support are recognized: direct financing and subsidizing of R & D, subsidizing interest rates on loans, loans from the Fund for the Development of Industry [4].

Thus, the importance of fast-growing high-tech companies in economic development at the macro level requires the state to increase attention to this segment.

DIRECTIONS OF IMPROVING THE SUPPORT SYSTEM OF RUSSIA'S HIGH-TECHNOLOGICAL BUSINESS SUPPORT WITH USING THE BEST WORLD PRACTICES

Foreign practice in the formation and development of a system for supporting high-tech companies has solid experience and deep historical roots. Introduced in the 80-iesXX century American researcher D. Burch, the term "technological gazelles" and to this day has not lost popularity in the scientific and institutional environment. At the same time, experts [16] note a gradual shift in the emphasis on the support entities: from companies that are at the startup stage to companies of the later stages of the life cycle (early growth, expansion), who have successful experience in high-tech markets and show an upward trend in growth rates business. At the same time, there are well-defined intercountry differences in the mechanisms and support instruments used.

In the study of R. Brown, C. Mason, S. Mason [17], the active participation of national and regional authorities in monitoring the results and assessing the effectiveness of the corresponding support programs in European countries is noted, while the forms of state support are very diverse. Thus, the Danish program of Growth Houses boils down, mainly, to advisory assistance. Multilevel consulting support and training programs are implemented within the framework of the Dutch program Growth Accelerator. In Finland, there is a positive experience in implementing the nationwide program "The Growth Firm Service", aimed at proactive identification of firms with high growth potential and their integrated support [18]. The broader practice of implementing complex programs at the federal and regional levels is characteristic of the British model of state regulation of technological development: the programs "Future Fifties", "Key 6%", "Companies of the Scale" [19, 20], etc.

As was noted at one of the conferences by D. Cameron, such programs are aimed at creating in the country a new powerful layer of export-oriented innovative medium-sized companies by analogy with the germaneMittelstand [21].

The Korean experience of large-scale support of the existing and "nurturing" of new national leaders of technological development within the framework of the programs of the Inno-biz Program, the Global Hidden Champion Promotion Program, the Purchase-Guaranteed New Product Development Program, World Class 300 and others is of practical interest. A wide range of business tools and customized support schemes are used for the Mid-Tier Companies Development Program launched in 2014 in

Malaysia [22, 23]. The effectiveness of the implementation of the above long-term programs is confirmed by the strengthening of the positions of Asian countries in the world market of high-tech products.

As noted above, the Russian experience in implementing state programs to support technological fast-growing companies boils down to the results of the practical implementation of the project launched by the Ministry of Economy of Russia in June 2016, "Support for private high-tech leader companies" (National Champions) [4]. Within the framework of the project, training programs for top managers of fast-growing companies are implemented, foreign trade organizations support participation in international exhibitions, measures are taken to facilitate interaction of high-tech companies with various state institutions, soften bureaucratic barriers.

We consider it advisable to make proposals on expanding (based on the analysis of international experience) and improving the system of support for "national champions" of Russia. In our opinion, a set of appropriate measures can be defined by the matrix "the stage of the company's life cycle - the level of business innovation" (Figure 3).

We believe that the practical use of the proposed approach will allow us to approach the problem of determining a specific set of targeted support measures for a specific subject category more rationally and in a balanced manner, this approach will help to increase the effectiveness of state regulation measures for the high-tech sector and turn it into a driver of the Russian economy.

| | | | |
|------------------------------|------|---|---|
| Level of business innovation | high | Development in the top management of competencies in the field of risk management Grant Support Development of the mentoring institute Perfection of mechanisms of stimulation of innovative activity of the companies Assistance in bringing products to the market (including external) Infrastructure support Information consulting, etc. | Stimulation of interaction with subjects of the research and business sectors Perfection of the system of personnel training for high-tech business Assessment of export potential Support for the withdrawal and promotion of products in international markets Promoting access to innovation-oriented capital |
| | low | Development of managerial competencies Consulting on the application of flexible financial instruments Promoting interaction with development institutions Help in overcoming administrative barriers Expertise of investment projects Legal advice, etc. | Development of top-management strategic vision Marketing support of business Facilitating access to sources of finance Assistance in the staffing of business Elimination of regulatory and legal barriers to business growth Development of new development tools, etc. |
| | | Early (seed, startup) | Average (early growth) |
| | | Stage of the company's life cycle | |

Figure 3: The main areas of support for high-tech companies (matrix "the stage of the company's life cycle - the level of business innovation")

CONCLUSION

Based on the results of the study, the following can be concluded:

1. The study of basic and modern concepts of technological development, despite the controversy in them, confirms the dependence of economic growth, grounded by leading foreign and domestic scientists, on the innovation and technological factor.
2. In modern economic conditions, the advanced powers of the world define technological development as a key aspect of strategic behavior designed to give an adequate response to a set of large challenges.
3. High-tech business in Russia is playing an increasingly important role in the national economy, ensuring the growth of its competitiveness in world markets, and becomes the object of close attention on the part of state structures.
4. Directions for improving the Russian system of state support for fast-growing technology companies should be based on the use of elements of the best world experience, taking into account the stage of business development and the degree of its innovativeness.

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