

УДК 32.330.341.1.

SCIENCE IS THE BASIS FOR A COUNTRY'S MODERNIZATION



The development of sciences and high technologies is the most real way for a country to occupy a worthy place among developed states. The level of national sciences to a great extent determines the fundamental basics of economical and military security of a state. The modern condition and transformation of Russian scientific and technological complex tendencies show that the country will not be able to become a leader of global and regional integrations.

Key words: science, economics, economy, modernization, innovation, technology.

Current trends of globalization and integration of world economy are characterized by the extensive use of information technology; the formation of an innovative economy; the internationalization of research, development and knowledge-based production; the aggravation of global competition in world markets of investment, high technology products and services. There are changing traditional forms and mechanisms of international cooperation in science and technology. The role of a government in the regulation of these processes is increasing. The close relationship of science and technology, foreign trade and economic policy is essential to overcome the existing economic crisis [1; 2].

Modernization, as the global socio-political thought is a prerequisite for the establishment of a new world civilizational change. It is based on a definition that modernization is the main law of social constant change, complexity of political, economic, government agencies

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and other features according to the needs of society's effective functioning. The theory of modernization has gone through several stages of development, acquiring new characteristics and trends that have made social, political, scientific, technical and managerial achievement. The current phase of civilization modernization called postindustrial or postmodern. Its basis is the primary role of fundamental knowledge as the core around which new technologies, economic and social progress of society are created. Its main features are changing the system values (the desire to discover man's talents and abilities), increasing the role and value of «human capital», understanding high price of intelligence. The formation of high management culture, the growing importance of information change human beings towards culture, education, spirituality and more.

The current state of the Russian economy and prospects for its modernization are closely linked with the state of the world economy, which is in the process of transition to a new technological and economic structure. Recovery of the world economy is linked to the wave of innovations that pave a way for the emergence of new technologies. The current systemic crisis should end in a few years with a flow of available capital towards producing the new technological way. It is in such times of global technological shifts are occurring opportunities for lagging countries to make a leap forward and show a world «economic miracle».

Conditions necessary for implementation of successful strategy of modernization are the development of basic industries forward to new technological structures and the establishment of the economy on a proper new long wave of growth. This requires concentration of resources to create the nucleus of new technological structures and to achieve synergy, forming clusters of new industries, providing consistency of macroeconomic policies with the priorities of long-term technical and economic development. The implementation of such a policy must create a strategic management system that could provide promising areas of economic growth and direct the activities of state institutions and instruments of economic regulation for their functioning [3].

This requires science and technology forecasting, strategic planning, choice of priorities of their scientific and technical potential, their implementation through the adoption and budgeting programs and indicative plans, methods and implementation of effective control mechanisms. A key role in the modernization and development of the economy based on a new

technological structure plays a sharp increase in innovative activity. In today's economy the share of STP accounts for 90% of total deposit growth of all factors. Viewing the critical and high uncertainty of research results state should take over the functions of an intellectual and information center of management and strategic planning for economic development, support for relevant scientific and technological environment, which includes the advanced base of fundamental knowledge and exploratory research institutes of applied research and experimental development, and stimulates the diffusion of new technologies. Throughout the world, there is consistently increasing R&D funding, whose share in GDP is up to 4%, which is three times more than one in Russian economy [4].

Today in Russia there is a critical situation with the development of research and implementation of technological modernization of production associated with the transition to a new technological way. The reasons for the unfavorable situation are chronic underfunding of science, the destruction of cooperation of science and industry, scientific personnel aging, «brain drain». Mostly they were the result of privatization, which led to the destruction of the industry sector of applied science. As a result of the disintegration, scientific production association designers offices, research institutes and design institutes lost their funding sources and virtually ceased to exist. The new owners of privatized engineering companies failed to ensure the production of technologically sophisticated products and change the profile most of them.

In August 2013 the Federal Law «On the Russian Academy of Sciences, reorganization of the state academies of sciences and amendments to some legislative acts of the Russian Federation» was adopted. RAS ceased to exist in the previous historical form, losing the bulk of its features and benefits. In addition, in March 2016 by the Government's decision to the Russian Fund for Basic Research (RFBR) was joined the Russian Humanitarian Science Fund (RHSF). RFBR was founded in 1992, two years later in connection with the specifics of humanitarian research RHSF was separated from RFBR. According to said Law, Federal Agency of Scientific Organizations (FASO) was created, the jurisdiction of which received all the scientific institutions of RAS and with all their possessions [5]. It was expected that the Agency will provide all the financial and economic activities of the institutes, and directly sciences will be under scientific

management of institutes. In fact, FASO manages not only the property, but also scientific activities of academic institutes. FASO commends the work of institutes, can combine and distribute them into different categories, which determines their funding. The Scientific Coordination Council of the FASO has developed various means of digital evaluation of institutions, including the Hirsch index, which shows the frequency of citations of employees' publications of institutes. But this figure can not be the main criterion for overall assessment of research institutes. In practice, FASO, without experts of high scientific level, is one of the main subjects of the formation of the state science and technology policy and considers it possible to manage the fate of Russian academic science, expressing the consolidated opinion of the scientific community. University science, which bet the last decade, is aimed at improving the Hirsch index as a key indicator reporting to the Ministry of Education and Science. Because of this, in terms of funding a researcher in high school science sector are 2.7 times higher than the funding of FASO.

Last time only RAS has been a strategic subject of science and technology policy. Before 2000 in RAS were concentrated 57% of all doctors and candidates of sciences [6]. Ongoing reform of RAS passes basic problems of management of STP, does not provide for the improvement of institutional forms and methods of applied research. It is not focused on the development and implementation of efficient high technologies. Now the most important goal of scientific, technical, structural and investment policy of Russia is to be the creation of powerful and innovative mobile capabilities that should cover and mutually bind large level of R&D, higher education and investment sector, especially engineering. The challenge is to generate and implement engineering and technology innovations to ensure their accelerated implementation in the economy. To normalize the economic productivity the emergence of sustainable demand for innovation and applied science is obligatory condition. The national scientific and engineering policy should concentrate primarily on ensuring a broad front of supporting basic research and long-term, resource-intensive and risky areas of up-to-date technology.

The report of RAS «On the Level of Basic Science in Russia. Moscow 2016» states that for the period 2000-2014 number of researchers who perform basic research in the natural sciences decreased approximately 10.5 thousand persons and in technical sciences - 20 thousand [6]. Lack of funds for the state

program «Development of Science and Technology» can lead to significant layoffs scientists. According to the MES of Russia, the share of the state program research budget in total expenditures will be reduced in 2019 from 0.98% in 2015 to 0.87%. The reduction will apply first of all academic institutions of FASO: the Russian Academy of Sciences and the National Research Centre «Kurchatov Institute». Thus the exemption can get about 10 thousand scientists.

In its foreign policy, the Russian Federation follows the concept of a multipolar world where it is trying to play the role of one of the poles of attraction. Russia is in integration projects BRICS [7] and SCO [8] with China, which demonstrates the great achievements in science and technology. Chinese science emerged and developed as an applied field of defense industry. All outstanding scientists in China graduated from American universities and provided a strong impetus to the national science. Today China, where in 40 of the last century, in fact, was not a single university, holds leading positions in science and technology field. In early 2016 Harvard Institute of World Economy said that China has moved from a copying country to an innovation state. Beijing reoriented internal parks from foreign investment to development, training and promotion of invention. At the beginning of 2015 China had 1,600 science and technology incubators and invested into more than 1 000 public institutions from the fund over 350 billion yuans. They specialize to invest in inventions. In 2016 China's State Council unveiled a program to promote the conversion of science and technology, reflecting the crucial role of science for wealth production [9; 10].

Since 2010 China ranks first in the world in the number of obtaining patents. China's office on intellectual property showed that in 2014 from 928 thousand 663 thousand inventions have a market value and 485 thousand were performed by specialized research centers. In 2000-2007 the number of engineers and technical workers in China doubled. It is predicted that in 2024 scientists and researchers in China will be more than in the USA, the EU and Japan combined. Already in 2013 China came in first place in the world in terms of scientific and engineering workers. Number of scientists from the total number of people employed in manufacturing in the EU is 22%, in China - 19% in the USA - 17%, in Russia - 6%. According to UNESCO, the Russian Federation is the only country where the number of scientists is declining, particularly in the period 2007-2013 from 7.3% to 5.7% [9; 10]. A quarter of the world high-tech exports, which in 2014

amounted to \$2.5 trillion, belongs to China. In 2014 China reached parity with the USA in respect of value added in high-tech industries, where the USA - 29%, in China - 27%, during ten years its share has grown 10 times. Russia's share in the global market high-tech products is only 0.3% [9; 10].

According to forecasts, in 2018 China will surpass the USA in the amount of investment in research and development, will accumulate a lot of knowledge and analytical data of scientific experiments that will contribute to the scientific breakthrough. Today China demonstrates the high efficiency of investment in education, particularly occupies one of the first places in terms of education (for example, the United States - just the eighth-tenth). It is believed that the level of education for China's future is the most important factor for competitiveness [10].

The current and future state of Russia's science is one of the key factors of national security. Specifically many defense enterprises have no scientific developments to create a new generation of weapons. Analysis of the strategy of scientific and technological development of Russia for the long term indicates that the destruction and decline of Russia's education and science will continue. As sciences play an important role in the development of a country and its economy, there must be a closed circle of innovation reproduction (problem analysis; basic, research and application development; creating technology; output of products on the market and sales). Investments derived from those activities should fund in all of the elements of the cycle. An important role in this must play major high-tech companies that create new efficient technologies, perform experimental development, manufacture products and display it in the world market. The main consumer of technologies is industry. During the reforms in Russia large technology companies did not appear. In addition, after the collapse of Russia's manufacturing industry plants became attached to western parts. All competition in the sector of high technology products in the world is based on the fact that some companies are trained to do what others can not do, earn some money and are not going to share their secrets. In Russia under sanctions there is an actual problem of import substitution, especially in the interests of defense. Experts estimate the number of positions that need to be replaced as tens of thousands while the current capacity of the country allow to replace only a few hundred a year. The former technological and scientific superpower actually became a raw material appendage of the developed countries.

Russia's defense budget in 2016 amounted to approximately \$90 billion, in China - \$150 billion, in the USA - more than \$610 billion. In 2017 it is planned to increase it sufficiently (approximately by 7-10%) in all of them. For Russia to have a solid defense in conditions far less funding it is necessary to achieve scientific and technological breakthroughs in the field of science and engineering since nuclear weapons in the 21-st century will not be a panacea. To ensure the necessary import of new high-tech products, to build new plants, to revive whole industries need on a new technological basis. This is due to planning, strategic outlook according to the science main role.

The leading countries (Israel, the USA, Japan, China, Finland, the Republic of Korea) provide successful scientific and technological development, have own scientific strategies, put massive challenges for their scientists and invest heavily in science and engineering. Officially, it is a widespread belief that Russia is in need of transition to innovative development, which is characterized by the introduction of institutions to support innovation. In Russia international institutes of innovative development, state-owned companies in knowledge-intensive sectors are created. Research and development of world-class laboratories in the university sector are supported. Federal institutions and digital infrastructure that implement common approaches to the management of public research organizations, including universities and institutes of RAS are formed. But effective results are absent.

It is believed that in Russia the most important trends affecting national science policy are: exhaustion of conventional resources, socio-economic growth of industrialized countries; slowing down the renewal of the environment due to increased anthropogenic load, the industrial revolution and the isolation of a limited group of countries which have a new technological package; increasing complexity and reducing manageability of socio-technical systems; demographic transition and change the way of life. For transformation of the research and development sector it is necessary to change the key tasks of state institutions, control functions and network administration of scientific organizations, to minimize the efforts aimed at the development of the regulatory system, to stimulate access to national and global technology market and high technology products. The government activities should be focused on creating high-quality and affordable services which are necessary for the implementation of creative and intellectual potential teams of researchers and developers [3].

Russian Joint Stock Company «Rosnano» was launched in 2007 for the development of nanotechnology [11]. The main purpose of the undertaking is to invest in private projects on creation of new nanotechnology industries. In 2010-2012 with the participation of «Rosnano» in Russia were established 30 such plants using nanotechnology. The volume of output in 2012 amounted to 25 billion rubles. But the Russian Chamber found that during the period 2010-2015 half of the corporation's investment was ineffective. The cost of state-exit brought a loss of 13.1 billion rubles. In projects where costs exceeded revenues consisted of state guarantees in the amount of 7.7 billion rubles. The goal was not achieved and implementation proved ineffective. For the last two years, «Rosnano» spent on the high payment of «success fees» for managers and the company's projects had a loss of 25.4 million rubles.

Innovation Center «Skolkovo» is a modern scientific and technological complex of development and commercialization of new technologies, which is based in Moscow [12]. Federal Law № 244-FZ «On the innovation center «Skolkovo» was signed by the President on September 28, 2010. One of the most important elements of Skolkovo is international cooperation. Among the partners of the project are research centers, universities and large international corporations. This is the first «scientific town» in the post-Soviet era which is built from «scratch». In the complex will be provided with special economic conditions for companies operating in priority sectors of economy modernization of telecommunications and space, biomedical technology, energy, information and nuclear technologies. State funding Skolkovo to 2020 should reach 152.2 billion rubles. It is planned that approximately 50% of the cost of establishing this center to raise from private sources. In an area of about 400 hectares will live about 15 thousand people, 7 thousand of them would daily come to the Innovation Center to work. As result Skolkovo should become an ecosystem that is able to develop business and research favorable conditions, to create companies successful in the global market. The most serious drawback of the project is the lack of strategic vision. This is the basic cause of major risks and existing problems, including corruption, financial irregularities and so on.

Economic sanctions, introduced by the USA and the EU after the annexation of the Crimea and Donbas aggression led to significant isolation of Russia from access to new technologies. If it does not find a way out of this situation during the near future, the Russian

economy will be in a state of irreversible lag and development of the new technological way. Today Russia needs to create a modern system of scientific and technological development of the country, since the main structural components of applied science were destroyed during the mass privatization. Total annihilation of design institutes and bureaus caused industry trend of transition for foreign technological basis. Extension of sanctions can lead to the destruction of many production cycles in different sectors of the economy, layoffs and bankruptcies of a number of enterprises, a significant drop in living standards. Without long-term joint work of state enterprises and citizens to implement rate on sovereign development based on advanced technology it is not possible to ensure the stability of the domestic social and economic order. Saving a situation of dependence of the Russia's economy on the western core of the global financial system leads to the extension and deepening of the crisis. Any improvements are impossible without changing the country's current raw model including into the world economy.

Conclusions

1. Only relying on a strong scientific and engineering complex may be most real way for any country to take its rightful place among economically developed states, to promote social approval-oriented, structure-innovative model of modernization. In the present state and trends of the transformation of Russia's scientific and technological complex the country will not reach the level of developed states to lead global and regional integration. Particularly in the integrated economic and political associations SCO, BRICS, Russia can actually serve only a minor partner of China.

2. In the Russian Federation reforms of science and technology are ongoing. Today, there still remained powerful enough scientific community. The number of scientists in Russia ranks the world's fifth after the USA, the EU, Japan and China. But in fact Russia is the only country in the world where the number of scientists is constantly decreasing. Compared with the Soviet Union scientists reduced in the number of two and a half times, by almost twenty times reduced funding for research and development. In terms of the share of R&D expenditure in GDP Russia found itself factually at the Third World (OECD - 2.3%, the EU - 1.94%, Russia - 1.12%).

3. Russia's share in the world market of high-tech products is at the level of 0.3%. The main problem of

Russia's scientific and technological complex is not with basic science which is still at the up-date level but with the almost complete elimination of plant sciences sector and with the privatization of industrial enterprises in the 90's of last century. As a result, demands on innovation from industry and proposals from applied science have fallen sharply.

4. Attempts to create new centers of innovation to «scratch» usually tend to fail as that occurred with long-term projects «Rosnano» and «Skolkovo». At

best, they realize the ideas imported from the academic environment, but usually they spend resources not for its intended purpose. In fact these innovation centers are a form of transformation of budgetary allocations to private development projects. International experience of successful innovation shows that it can develop only in favorable collective scientific and technical working environment which academic research institutions support.

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Розвиток науки і високих технологій – найбільш реальний шлях для країни зайняти достойне місце серед розвинених держав. Рівень національної науки в значній мірі визначає фундаментальні основи економічної і військової безпеки держави. Сучасний стан і тенденції трансформації російського наукового і технологічного комплексу свідчить, що країна нездатна стати лідером глобальних та регіональних інтеграцій.

Ключові слова: наука, економіка, модернізація, інновація, технологія.

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Развитие науки и высоких технологий – наиболее реальный путь для страны занять достойное место среди развитых государств. Уровень национальной науки в значительной степени определяет фундаментальные основы экономической и военной безопасности государства. Современное состояние и тенденции трансформации российского научного и технологического комплекса показывают, что страна не в состоянии стать лидером глобальных и региональных интеграций.

Ключевые слова: наука, экономика, модернизация, инновация, технология.

Стаття надійшла до редакції: 20.02.2017

Рекомендовано до друку: 03.03.2017