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TRENDS AND CHARACTERISTICS OF INNOVATION WORLD AND RUSSIAN ECONOMY

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ABSTRACT

Innovative development of Russia is explored in the article as a complex process that reflects the latest trends in the production, stockpiling and use of modern knowledge, priorities of scientific and technological development, changes in the structure and dynamics of the financing, development and implementation of innovative technologies in the public research centers, universities and private sector companies economy, formation of research and innovation policies aimed at making the research and preparation for the future of innovation sphere. The problem is to organize support the positive dynamics of the innovation process. The solution is possible based on the integration efforts of the Russian society to create a system of technological and socio-economic forecasting, select sources of funding long-term priorities of fundamental and applied science, education for constructive solutions to the problems facing Russia. In line with the above priorities, the author examined the key factors that characterize tendenuiyu accelerate the innovative development of the Russian economy: the global growth of knowledge-intensive production of gross domestic product, the priorities of the state scientific and technical policy of the most economically developed countries, strategies for high-tech business leaders.

UDC & KEYWORDS

■ O38 ■ INNOVATION DEVELOPMENT ■ RESEARCH INTENSITY ■ RESEARCH AND TECHNOLOGY POLICIES ■ STRATEGIC INNOVATORS ■ INNOVATIVE LEADERS

INTRODUCTION

Innovative development, according to the examples of best practice - a complex process that reflects the latest trends in production, stockpiling and use of modern knowledge, the priorities of scientific and technological development, changes in the structure and dynamics of the financing, design and development of innovative technologies in the public research centers, universities and companies the private sector, the formation of research and innovation policy aimed at transforming research and training areas for future innovation. To maintain the positive dynamics of the innovation process to a systematic improvement of the technological and socio-economic forecasting and finance long-term priorities for fundamental and applied science, education for constructive solutions to problems facing the global economy in general and Russia in particular.

Factors determining the general trend of accelerating the innovation of the world economy

In connection with the task considered the most important factors determining the general trend of accelerating the innovation of the world economy: the global growth of knowledge-intensity of manufacturing in gross domestic product, the priorities of the state scientific-technical policy of the most economically developed countries, strategies for high-tech business leaders.

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The global growth of knowledge-intensity of manufacturing in gross domestic product

Increased knowledge-intensive means widening the scope of research and innovation activities relative to the size of the gross domestic product or value of production of individual companies. This rate applies to a large number of countries, industries and corporations. Developed countries are characterized by high levels of research intensity, which provided a high proportion of private sector companies in the national expenditure on research and development activities. Among the champions for the knowledge-intensity of gross domestic product of Israel, research intensity of gross domestic product - 4.7% and Sweden, in which the research intensity of gross domestic product is 4.3% (Russian Academy of Sciences, 2008).

These figures show the maturity and balance of national innovation systems. In the forecast period for the group of most developed countries may be a slight increase or stabilization of indicators knowledge-intensity of gross domestic product. Leading the increase in costs for research and development activities in China and India will lead to the end of the forecast period, a significant convergence of knowledge-intensity of their performance with those of developed countries. It can be concluded from the table 1 if they follow the trends they can substantially beat Russia. At the present time in certain areas of information and communication technologies, South Korea, China and India have moved from "catching up" of the "leading".

The prospects of resource provision research and development activities in the European Union look uncertain. As you know the European Union as a whole lags behind the USA and Japan in terms of research intensity and dynamics, innovative development slowed.

Table 1: Forecast financial support of leading scientific countries and regions (the cost of research and experimental development to gross domestic product)

Years	USA	Japan	EU	Russia	India	China
2000	2,72	2,9	1,89	1,05	0,95	1,01
2005	2,72	3,2	1,87	1,25	1,45	1,34
2020	3	3,5	2,4	2,25	2,4	2,5
2030	3,1	3,5	2,5	2,3	2,5	2,6

Sources: Russian Academy of Sciences. (2008). Forecast of development of the world economy by 2020. Report at the conference «Russia in the global economy». Moscow.; Dynkin, A. (2008). The world economy: outlook to 2020. Moscow: Publishing House «Master».

Back in 2000 it was decided to make more use of the reserve for economic and social development, to accelerate the growth of financial and human resources research and development activities, and by 2010 bring them to the level of leading countries. However, in 2005 it became clear that these solutions will fail, and their implementation has been postponed to 2013. In this current indicators suggest that the gap in innovation continues to deepen. European companies are relatively weak master high-tech industries

- biotechnology, pharmaceuticals, information technology. Their positions are the most stable in the medium-tech areas - automotive and aircraft industry. Rapid growth of public spending on research and development activities in a number of new areas (alternative energy, nanotechnology, new materials, etc.) until it became a positive signal and a reference point for private business (Dynkin, 2008).

Currently, the bulk of the scientific and technical resources concentrated in the countries of the world economic cooperation, China, Russia and India. Table 2 shows that the share of USA - about 30% of global spending on research and development activities, the European Union countries - about 25%, Japan - 13%. The current triad of major scientific and technical centers (USA, EU and Japan) will grow at the expense of China and India (Russian Academy of Sciences, 2008; Dynkin, 2008).

Table 2: The share of countries and regions in the financing of research and experimental development

Regions and countries	2004	2005	2006	2020
Europe	24,6	23,8	23,4	20
North and South America	37,8	37,5	37,1	35
USA	32,7	32	31,3	28
Asia	37,6	38,7	39,5	45
China	11,8	12,8	13,6	20
Japan	13	12,6	12,4	12

Source: Russian Academy of Sciences. (2008). Forecast of development of the world economy by 2020. Report at the conference «Russia in the global economy».

In the forecast period will increase research intensity in relation to expenditure on research and development activities, the cost of production and capital expenditures per researcher. High levels of research intensity (the ratio of expenditure on research and experimental development to sales) now have a company representing the pharmaceutical industry, communications facilities and services in this area, instrumentation and software. Main trends of resource support research and development activities early twenty-first century in developed countries are likely to continue to operate without major changes in the next 10-15 years. Increased costs will be, obviously, mainly due to the business sector, the expansion of private business co-operation with universities and public research centers, to reduce direct government funding of private industry and strengthen the indirect stimulation of business from the state. The ratio of private and public sector in financing research and development activities will seek to 70:30 aspect ratio, but with variations that reflect the specifics of individual countries.

The priorities of the state science and technology policy the most economically developed countries

In setting priorities in this important field are taken into account above all the national peculiarities of the economy and social sphere of the individual stations. For example, the priorities of scientific and technological development in the USA and the EU are: the relative decline in the share of military research and development activities in the total amount of public spending, rapid growth of investment in basic research related to the health care system, a marked decline of interest in research and development in nuclear energy.

In the countries of the economic cooperation in general was a decrease in the relative share of public sector subsidies to national research and development activities. Over the last ten years the value of this index by country of economic cooperation was reduced from 35 to 29.9% in the EU from 40 to 34% (Dynkin&Ivanova, 2008). Among the most important factors causing a relative decline in the share of government financing of research and development activities, can be called a reduction in military spending and the decline of the national large-scale scientific and technological programs. As for the big government programs mobilize national resources for solving various scientific and technological problems of a strategic nature, then at the present stage of development they become more inefficient.

In the first decade of the twenty-first century, there has been a shift of most post-industrial countries to a new phase of the state scientific-technical policy, the general direction of which is the solution of socio-economic problems. At the forefront of addressing the requirements associated with unemployment, health and quality of life.

The package of measures to stimulate innovation in all aspects becomes the center of the new state science and technology policy. Bet on innovation is seen as a priority means of socio-economic changes. The state is increasingly playing a role of partner of the business sector, not in order to assist businesses in maximizing profits, but to facilitate the commercialization of the most effective in terms of social innovation.

In these circumstances, the priority in choosing the directions of development are the following considerations: public demand, stemming from the expectations of the general public (health, environment, quality and living conditions, security of property and people); need to support sectors with growth potential (the point of growth in gross domestic product, exports and new jobs); interdisciplinary research (environment, nanotechnology, the creation of the Information Society). On the basis of these criteria will be the main choice of priorities for public funding. The specifics of each country will be in the combination of different disciplines, methods, approaches, and different organizational, institutional, financial and other mechanisms, which allows to realize these key priorities identified.

The priority of innovation policy among the tools and instruments of government regulation is typical for all developed countries. At the highest political level proclaimed and then actively pursued the task of accelerating the development of innovation as a foundation for economic growth. There is a mobilization of political elites, with the participation of all sectors of business and civil society. Commitment to public policy of this problem is particularly important in times of crisis, when the developers of innovations, and investors, and consumers lose confidence in each other and need both moral and material support.

Act on urgent measures to stabilize the economy in 2008 (Emergency Economic Stabilization Act of 2008, EESA), better known as the Paulson plan, adopted in the USA in the most acute phase of the financial crisis contains a set of solutions, which is much broader then the task of overcoming their own financial difficulties. Central position in the list of incentives for business take tax relief for expenditure on research and development, implemented in 2008-2009. First, the increased rate of tax credit from 12 to 14% of the amount that exceeds 50% of the average expenditure on research and development activities for the preceding three years. Secondly, greatly simplified the rules governing the process of obtaining this benefit. Third, reduced taxes for employees of technology companies who had stock options on the assets of their companies (incentive stock options), but did not receive the expected revenue this year (Dynkin, 2009).

In accordance with this Act, the industry supports energy development priority. Provides a range of incentives to

producers and consumers of energy, both to individuals and businesses. It is important that the proposed incentives are focused on new, more efficient methods of energy levels in the main consuming sector (housing, offices and manufacturing facilities, transportation) and are designed not for one or two years, and the long period of time. Long-term nature of most event space indicates that no additional state guarantees for key priorities and incentives for innovation policy can not be the solution of fundamental problems of development.

Table 3 shows that the main form of direct government support for innovation development - government funding of science, research and development.

Table 3: Budget funding for research and development in the USA

Cost function	2007	2008	2009	2007-2008	2008-2009
Total research and development	138087	137972	142605	-0,1	3,4
National defense	82273	81050	84091	-1,5	3,8
Health	29461	29634	29783	0,6	0,5
Space research and Technology	9024	9233	9728	2,3	5,4
Fundamental research	7809	7915	9012	1,4	13,9
Energetics	1893	2374	2463	25,4	3,7
Natural Resources and Environment	1936	2008	1987	3,7	-1
Agriculture	1857	1852	1616	-0,3	-12,7
Transport	1361	1340	1345	-1,5	0,4
Other	2475	2566	2579	3,6	0,5

Source: Dynkin, A (2009). Report “Prospects for a Global Innovation Development.” Moscow: Bulletin of the Russian Academy of Sciences, 79 (3), pp.202-206.

The biggest scientific articles of the budget are defense, health, space and basic research, and in the dynamics of the last two items a priority. Slower than expected growth in federal spending on energy research, reducing the cost of the study of natural resources and agriculture.

Revision of the state's priorities in a crisis, taking into account the arrival of the new USA administration can be very significant, but the practice of past presidents of crisis and change, research costs are affected in the least degree.

The priorities of the private sector

The share of business sector expenditure on research and experimental development of economic cooperation has increased significantly in 1990-e years, and in the 2000s is from two thirds to four fifths of national expenditures (Milner, 2009). In the forecast period, the global trend growing share of business sector expenditure on science will be enhanced by increasing the role of this segment of the national innovation systems in China, India and Brazil.

World's largest corporations, as a rule, are among the leaders in expenditure on research and development. At the end of the twentieth century, the most ambitious in terms of cost and innovative research projects carried out by automobile companies, as well as information and computer giant IBM and Misrosoft.

Currently, this group joined by several pharmaceutical companies. By the features of the leaders of innovative development must be added the important fact that the concentration of resources in this area is very high and, despite the rapid growth of small and medium-sized high-tech companies, most of the national scientific projects carried out large companies. For example, in 2007 the share of the ten largest corporations accounted for more than 30% of the cost of research and experimental development of American business, on the top 100 - have 90% (Milner, 2009).

In most of the latest high-tech industries the size of the firm remains the most important factor of competitiveness, and the leader of the modern technological race can only be a very large company. The survival of a large company of high technology industries is possible only when exceeding a certain critical level in financial terms, which is constantly growing. It is no accident priority for companies is the problem of capitalization growth, increasing trade, the conquest of leadership in the global market. As a result - continuing to the 1990s, the process of mergers and acquisitions, which has affected virtually every major global companies. Especially clearly it appeared in such high-tech industries such as aerospace and military electronics.

The key to the success of a large company - continuous innovation across a broad front. Equally important are new products and production, and introduction of new technologies and new models of production organization and management, and new approaches to marketing, and search for new market segments. Long-term structural shift in the activities of large companies is growing share of services, which accounts for much of the innovative projects and trade.

Strategies for high-tech business leaders

With all the variety of innovation a key part of the innovation process is the creation and use of new knowledge or technology resulting from research and development. This understanding of the innovation process does not mean that it involves only the company, leading in the development of new technologies, or the guiding most promising research. Innovative business - this business that enhance the technological development of traditional industries. International statistics relates to the following types of innovation activities: research and development, acquisition of new machinery, equipment and technology, industrial design work, acquisition of patents or licenses, purchase of software and training.

Moreover, the most comprehensive understanding of innovative processes and includes a wide range of institutional, organizational and managerial innovations.

To improve the competitiveness of individual enterprises, companies, industries and entire countries are the most important innovations are the result of research and development activities. From this point of view in any industry there are several types of innovation-active companies:

1. Strategic innovators - are considering large-scale long-term projects of research and development activities as the main resource of competitiveness. Typically, these companies are a source of radical innovation for other sectors.
2. Periodic innovators - lead their own research and development work of necessity or, under favorable conditions, but do not consider the creation of a key innovation, the strategic objective of the company.
3. Modifiers technology - do not perform the full cycle of research and development activities, but use engineering to improve the products and processes.
4. Users of technology - to innovate by adapting technological solutions developed by other companies or organizations.

The level of innovation development of each sector is determined by the share of strategic innovators, establishing long-term trends of technological development, the competitiveness of the national and international markets. In addition, strategic innovators have strong competitive advantages in obtaining intellectual rent, the maximum value and the highest estimate of the financial markets, the assets of these companies. The predominance in the economy or any sector companies of the third and fourth type employed in the adaptation and modification of the main leaders of the proposed technological solutions can provide an acceptable level of current competitiveness in the national markets, but can not guarantee success in the competition in global markets and long-term sustainable development of national producers.

Statistics on research and innovation suggests that the scale of funding research and innovation in the enterprise sector in developed and newly industrialized countries at the beginning of the XXI century grew, despite the crisis in a number of high-tech industries. Work on the new features not only stopped, but in general, even expanded. In 2007 most knowledge-intensive industries have been representing the information complex and pharmaceuticals, where research intensity as the ratio of expenditure on research and experimental development to sales of 15-20%.

Scientific and innovative projects undertaken by these companies - strategic innovators, require funding, academic budgets comparable to some European countries. Only such magnitude scientific activities provide long-term growth and competitiveness in global markets.

For companies not included in the number of strategic innovators, the priority is the search, selection and use of the proposed innovators in science and technology. In today's global economy, dominated by the free movement of goods, capital and financial resources, the use of knowledge as a unique resource in its nature is a special competence. Gaining process of embedding enterprise of traditional industries in the structure of the "new economy".

Processes to improve the quality of capital, its continuous updating on the basis of modern technology dominate the quantitative expansion. As a result, along with new products, processes and industries, accelerate technological upgrading of traditional industries. The basis of technological modernization laid:

- use of information technology as an integrating element management systems of production and logistics, management and design;
- new forms of flexible automation, allowing the maximum degree of focus on the individual needs of the consumer;
- the development of global value chains that integrate geographically dispersed phase development, production and sale of goods and services;
- the rapid spread of technological innovations through the world trade through global production and marketing structures of transnational corporations;
- strengthening the role of international standards for systems that provide both the technical conditions of production of goods for global markets, and quality requirements, environmental, health and safety of consumers.

The growth rates of capitalization of stock markets in Europe and the USA, were interrupted by the financial crisis at the beginning of the XXI century, when the markets hardest hit is the innovative sector. Financial markets, supporting the competition proved to be a tool, which provided technical progress.

In 2003-2004, the scope of innovation has overcome the crisis, the leaders of the world's business began to increase the scope of research and development activities, went to the training of new and innovative breakthroughs. In August 2004, held its first public offering of shares of Google. Revenues amounted to 1.67 billion dollars. In three years Google has been among the leaders of the world economy, taking a high rating for Financial Times capitalization exceeded $ 105.4 billion.

The crisis in the financial sector that began in the second half of 2007, the most affected banks, especially professional in the mortgage, and then, in 2008 - and several other financial institutions, including pension funds, risky operations conducted at the national and global markets. The dynamics of the market value of shares of high technology companies during this period did not significantly differ from the average of the regional markets. As a result, large companies that manufacture technologically sophisticated products and services, continued to dominate in the modern industrial structure of the market capitalization of the global economy.

The crisis in financial markets in October 2008 made the threat and practical problems for many companies, high-tech and technologically sophisticated business.

The most serious problems are automotive companies - leaders of the private sector to the total amount of funding scientific research and experimental development and production of innovative products.

Company information business began to take tough measures to restructure and reduce costs. The company Yahoo in October 2008 r. announced the need to reduce staff by 15 thousand persons, that is approximately 10%. The company's profit in the III quarter of 2008 decreased by 64% due to a sharp fall in the scale of advertising. Reductions began in the small business innovation.

According to the National Venture Capital Association, in the fourth quarter of 2008 reduced the size of venture capital investments. However, several indicators of the venture capital industry suggests that the crisis had already begun to develop processes in early 2008 r. The number of companies entered the market of IPO in the first quarter of 2008 was six times less than in the fourth quarter of last year, and the amount of venture capital, who participated in these transactions, was 10 times less.

The capitalization of NASDAQ high-tech stock exchange declined since the beginning of 2008. Prospects for venture financing fell sharply. According to research firm New Energy Finance that studies this market segment, the number of venture capital projects in the field of "clean technologies" (wind, solar, tides) was reduced by the end of 2008 by 25%, and this trend continued until the end year. In addition, the company has become increasingly difficult to obtain funds through the stock market. The index of the dynamics of share prices in this segment, according to the same company, declined faster than the average of the global financial markets.

Against the backdrop of the crisis have been much better prospects for biotech sector in which demand for the proposed technology and the products were less likely to change the current situation. In mid-2008 according to PricewaterhouseCoopers, there was an increase of venture financing in this segment by 10% compared with the previous period and by 21% - with the corresponding period of 2007.

Table 4: The main indicators of economic growth in India, China and USA

Country	Average annual growth in productivity,%			Gross Domestic Product (% of USA)		
	1995-2004	1995-2000	2000-2004	Only	On the one employed	Per capita population
USA	2	2,3	1,7	100	100	100
China	5,5	3,1	8,6	71	13	16
India	4,2	4	4,4	28	10	8

Source: Russian Academy of Sciences. (2008). Forecast of development of the world economy by 2020. Report at the conference «Russia in the global economy». Moscow.

Among the regional innovation leaders confidently holds the championship of China, became the fourth economy in the world in terms of gross domestic product (Dynkin, 2009; OECD, 2007).

As is seen from the table 4 high rates of growth of Chinese economy has led to important qualitative and quantitative changes in the country. The most important qualitative changes that distinguish this country from other major economies have high growth rates of productivity change in the structure of gross domestic product in favor of service industries and manufacturing industries, as well as improving the innovation component of growth, expressed in the accelerated growth of knowledge-intensive production and exports, increasing the number of scientific and engineering personnel.

The share of high-tech products in China's exports rose from 5% in the early 90s of last century to 30% in 2005 r. Most of the exports are based on information equipment and household appliances. In 2004 China became the largest exporter of information and telecommunication technologies.

However, these undoubted achievements in the country's integration into the global innovation process manifests some of the specifics.

First, the share of exports of high technology industries is small and declining share of the newest segment - manufacture of pharmaceutical products, precision instruments, and aircraft.

Second, advances in exports of information and telecommunications technologies of industrial products based on the use of low-wage labor in an industry that is actively imported technology, equipment, parts and components. Exports of information and telecommunication technologies is largely foreign-controlled companies and the industry in China are less knowledge intensive than Western ones. Despite the fact that the company developed countries open up more and more research units in China, they do accompanying, secondary, non-strategic functions. As a result, Chinese exporters of products includes a relatively small component of value added and sold at low prices.

In 2005 National Center for Science and Technology of China issued the long-term forecast of development of technologies in the years 2006-2020. The authors make a conclusion about China's backwardness in terms of scientific and technological development of the world's leading countries by an average of five years. The survey of the scientific expert community has shown that research and development activities can be successfully implemented only through the involvement of national resources, while in the field of biotechnology and computer science to China need to rely on international cooperation. Long-term forecast was aimed at developing an action plan, which aims to transform China in 2020 in the "innovation-oriented society," and in 2050 - a world leader in science and technology. Current problem - reducing dependence on foreign technologies, the growing over the past two decades due to government policy, "the market in exchange for technology." It led to a rapid transformation of China's export-oriented industrial center of global significance.

The rapid increase in production capacity of China is associated with the development of the international division of labor, which resulted in the country, using its traditional competitive advantage and attracting foreign investment has become a "global factory". However, in modern conditions participation in global production chains is not only the ability to ensure low production costs, but also to international quality standards, transportation and information systems, corporate governance. Moreover, the greatest advantage of the country are offering scientific and technical innovations in the form of new standards, patents, licenses and other intellectual assets. The possibility of transition to a form of participation in global production chains, is one of the central questions of the formation of China's future innovation.

All these issues were discussed at the Congress of the Communist Party of China. The decisions of the Congress, the problem of transition to innovative development of the endogenous, that is, relying on their own business - strategic innovators, is formulated as one of the most important national goals. Strategic Plan for Development of Science and Technology 2020, Approved by Congress, exporters of information and telecommunication technologies, includes the following provisions: the creation of an effective national innovation system, and increase spending on research and experimental development, emergence of China as "innovation-oriented society", the creation of innovative advanced economies, the transition to endogenous innovation.

The great potential of the country's ability to quickly learn the priorities of technological development evidenced by its success in the field of nanotechnology. Leaders of research, development and exploitation of nanotechnology are USA, Japan and Germany, but China is rapidly increasing all the population in this area. For example, American scientists published from 1995 to 2006 about 43 thousand of articles on nanoscience and technology, in second place - Chinese experts from 25 thousand articles. The size of the financing of this direction, China is lagging behind dozens of times. In third place - Japanese scientists. China also belongs to the primacy of the pace of development in this direction. For example, in 2006 published 6 articles thousands of topics Nano, which is slightly higher than in the USA, and two times higher than in Japan. Nano programs implemented in 50 Chinese universities, 20 institutes of the Academy of Sciences and 300 businesses. The number of people employed in these programs, scientists and engineers over three thousand people (Milner, 2009).

Conclusion

In order to support the dynamics of the innovation process should be systematic improvement of the technological and socio-economic forecasting and long-term priorities of funding basic and applied science, education for constructive solutions to problems facing the global economy in general and Russia in particular.

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