УДК 330. 341.1

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THE NEW VECTORS OF TECHNOGLOBALIZM

Absract. Globalization as an objective process touches all spheres of life of the world community. One of its manifestations is technological globalization (technoglobalizm), which finds its expression in the growing internationalization of technology transfer, international technological cooperation, and global exploitation of technology.

The aim of the research is an analysis of the newest trends in the world technological and innovative evolution and, on this basis, determination of new vectors of technoglobalizm, selection of major regions of the R&D concentration in the global economy and revealing their characteristics.

In the world market of innovations there have occurred some changes that consist, first of all, in the reduction of the role of the USA and other G-7 countries as major leaders in R&D spending and an increase of the role of BRICK countries (Brazil, Russia, India, China and South Korea – according to the latest research of Intellectual Property & Science Department of Thomson Reuters Corporation) in financing scientific and technical developments, as well as some other developing countries.

Five major centres of R&D concentration and development, namely the USA, the European Union member states, Japan, and a group of developing countries, China, India, South Korea (in Asia-Pacific region) and Brazil and Mexico (on the American continent) are being formed. It is possible to predict that in the near future they can come out on top by the volume of R&D investment.

BRICK countries (Brazil, Russia, India, China and South Korea) form their own specialization in the field of innovative and technological development, which enables them to benefit from the available competitive advantages as efficiently as possible while avoiding excessive competition.

In conclusion, technological globalization has led the to the formation of major centers of R&D concentration - namely the United States, the European Union, Japan, and a group of developing countries, BRICK countries in particular. Leader countries are gradually losing their positions, and against this background one can observe the growth of highly competitive economies in the newly industrialized countries. Benefiting from their own competitive advantages and effective state policy in the field of stimulating foreign investment, they become global producers of new technologies.

Keywords: innovation, technological globalization, vectors of technoglobalizm, innovative and technological development, Research & Development (R&D).

JEL Classification: F01, F29, O33, O57

Statement of the problem. One of the main features of the development of the world economy at the beginning of the XXI century was expansion of globalization that affected all spheres of social life, including R&D. The processes of production and technology transfer have become international. Global exploitation of technologies, development of transnational technological cooperation and generation of technologies are a clear manifestation of technological globalization and technoglobalizm. Technoglobalizm promotes intensification of the exchange of the humanity achievements in different fields of activity, but in the same way deepens the uneven nature of the development of the world economy and leads to the aggravation

of global problems, including ecological, food, resources, demographic etc. Global spread of technologies entails the emergence of new centers generating innovation. "Triad" contries yield their positions to the newly industrialized countries which due to their present competitive advantages develop national innovative systems.

Analysis of the recent research and publications. A number of foreign and Ukrainian scientists conduct research into technological and innovation development on the global level. Among the foreign scientists one can distinguish the works of William Kerr [1], Michael W. Toffel [2], Kevin Boudreau [3], Patrick Gaule [4], Karim Lakhani [5], Emelyanov V. [6] and others. No less attention should be paid to the works of such Ukrainian scientists as Geyets V. [7], Seminozhenko V. [8], Lukyanenko D. [9], Stolyarchuk J. [10], Bazhal Y. [7] and others. However, the questions of forming new vectors of technological globalization in the light of selection of corresponding regions of technologically-innovative development with peculiar characteristics need to be further considered and substantiated.

The aim of our research is an analysis of the newest trends in the global technological and innovative evolution and, on this basis, determination of new vectors of technoglobalizm, selection of major regions of the R&D concentration in the global economy and revealing their characteristics.

Basic results of the research

Factors of the development of technoglobalizm. Being based on the achievements of technological progress, globalization causes changes in the configuration of the world economy, increases asymmetry between the developed countries and the rest of the world, intensifies international competition. The highest level of globalization is characteristic of science intensive spheres, which is related to the acceleration of the motion from one technological decision to a more perfect one, reduction of the time between the invention of a new product and its application, and swift dissemination of innovations through the channels of the world trade.

Expansion of technoglobalizm was strongly influenced by the world market of technologies. Today technological exchanges exceed traditional global economic flows of goods, services and capital. The experts estimate the total world market of

high-tech goods at more than 3 trillion USD and predict ever-increasing rates of its growth in the future.

Recent development of the global technology market is closely linked to such global processes as expanding of specialization and cooperation in the production of science intensive products, high technologies, new types of production materials, fall in demand in the world market of raw materials, especially due to the application of the energy- and resourcesaving technologies by the developed countries; changes in the international division of labor caused by fast generation of scientific and technical knowledge and information.

It should be noted that the global technology market has a multi-stage structure: if the high technologies are revolving between the economically developed countries, in the other countries – mostly middle (traditional) technologies and even obsolete ones.

Innovative activity of the countries has become a crucial factor of the global economy growth. It is impossible not to consider the changes that take place in the global market of innovations. They consist, first of all, in the reduction of the role of the USA and other G-7 countries as major leaders in R&D spending and an increase of the role of BRICK countries (Brazil, Russia, India, China and South Korea - according to the latest research of Intellectual Property & Science Department of Thomson Reuters Corporation) in financing scientific and technical developments [11], as well as some other developing countries. As a result, according to the scientists prognostication, by 2020 the GNP of China will exceed the GNP of any other leading country of the West, except for the USA; the GNP of India and Brazil will attain, and probably exceed the indices of the leading countries of Western Europe, and Indonesia will get around the indices of some European countries [12]. Even though the economic dominance of the leading countries of the West will be gradually lost, it will be retained due to their technological leadership resulting from the high development of human and intellectual potentials, social and economic institutions, and infrastructure.

By the level of spending on scientific developments the USA continues to keep leading positions in the present-day global economy. It takes place due to the fact that the establishment of an innovative system in the country started earlier than in the other ones and it passes more vigorously and more extensively. R&D spending in the USA is characterized by certain stability. After the reduction of the rate of growth in 2001-2002 it increased again from 220 billion USD to 377 billion USD in 2008. There is no doubt that the economic crisis has badly influenced the growth of spending, though the reduction of R&D spending passes slower than the fall in the other indices [13].

The USA has considerable financial, human and other resources that are necessary for the development of innovative economy. The country constantly attracts foreign specialists, which allows to save money for training specialists of the highest qualification (the cost of training one Doctor of Science in the nuclear power field is 500,000 USD, Doctor of Science in chemistry - 100,000 USD) about 5 billion USD annually [10, 14]. It should be noted that considerable use of foreign qualified staff is a component of the state policy of development of innovative economy.

In the USA financing of R&D is mainly provided by private companies and fundamental research is financed by the state. The increase of federal R&D investments is accompanied by stimulation of private capital investments in R&D, which attained a record size for the first decade of the 21century - 2,02 % of the GDP [6]. In the period of 2009-2012 the defense expenditure in the general volume of R&D financing from the federal budget grew shorter, at the same time financing of researches under the National Science Foundation, Department of Health and Human Services, Department of Energy increased [1, 15, 16].

In spite of the leading technological positions of the USA, global changes, which consist in forming national innovative systems in the developing countries, are obvious. An important role in these processes belongs, first of all, to such countries as China and India. Even American and European transnational corporations intensively invest in R&D abroad. In such countries, as China, Singapore, India, Brazil, Mexico global companies are attracted by the highly qualified labour force which achieved

worthy education in the USA and Europe and returned to work to their home countries, reliable and, most importantly, acting system of intellectual property protection and a well developed research infrastructure. For developing countries, foreign investment in R&D means not only jobs for thousands of qualified employees but also a possibility to gain experience and acquire appropriate knowledge in some field. Researchers from developed countries often move within global corporations to work abroad to the countries with rapidly growing economies. Thus, a global market for qualified labor is being formed, demand for which is costantly growing worldwide.

The main global centers of innovative and technological development. It can be asserted that five major centers of R&D concentration and development, namely the USA, the European Union member states, Japan, and a group of developing countries, China, India, South Korea (in Asia-Pacific region) and Brazil and Mexico (on the American continent) are being formed. And by observing trends in research and development in developing countries, we can predict that in the near future they can come out on top by the volume of investment in R&D.

The highest growth in R&D funding was achieved in China, which in 2011 was placed second by this indicator - 153.7 billion USD after the U.S.A. - 404.7 billion USD (Table 1) [15, 16, 17, 18].

Table 1

Funding indicators of "top ten" leading countries by total R&D expenditure, bln.USD

Country	2010		2011		
	R&D expenditure	R&D expenditure in % to GDP	GDP	R&D expenditure	R&D expenditure in % to GDP
The USA	395,8	2,9	14963	404,7	2,7
China	141,4	1,4	10747	153,7	1,4
Japan	142,0	3,3	4339	144,1	3,3
Germany	68,2	2,8	2957	69,5	2,3
South Korea	42,9	3,0	1512	44,8	3,0
France	41,5	2,26	2176	42,2	1,9
Great Britain	37,6	1,77	2218	38,4	1,7
India	33,3	0,9	4193	36,1	0,9
Canada	23,7	1,8	1357	24,3	1,8
Russia	22,1	1,0	2288	23,1	1,16

Source: calculated using data from [19, 20, 21, 22].

It should be emphasized that increasing R&D funding did not stop even during the global economic crisis, when some states had to stop funding a number of budget items. The trend of the growth of R&D investment is obvious, but according to the experts the major "players" in this field may soon change (Table 2).

Table 2

Indicators of R&D financial support of the leading countries and regions,

as percentage of GDP

Year	The USA	Japan	EU	Russia	India	China
1995	2,51	2,70	1,80*	0,97	0,90	0,61
2005	2,72	3,20	1,87	1,08	1, 45	1,34
2020 (prognosis)	3,00	3,50	2,40	2,25	2,40	2,50

*EU consisting of 15 countries

Source: [12, 14].

Thus, there is some levelling of the volumes of R&D financing in the developed countries and in the developing ones. But, taking into account the fact that in many spheres of science the newly industrialized countries have the highly qualified labour force which by the level of education and qualification is not inferior to the workers from the developed countries, and at the same time it is cheaper, and the production costs of scientific developments in these countries are going down. That is the fact that explains why many global corporations transfer their research centers to the countries - new industrial giants - India, China, South Korea, Brazil, Mexico. Thus, the U.S.A. investments in R&D abroad grow in volume at higher rates, than in the country. Their share in the total industry spending on R&D increased from 11.5% in 1994 to 15.3% in 2004 [13, 20]. In India, for example, more than 300 transnational corporations created their own research centers, which use cheap, but highly qualified labor force and appropriate research infrastructure.

Priority directions and industries of innovative and technological development of the countries. Having studied the processes of globalization, the leading economists made a conclusion, that today the world is at the stage of a new industrial revolution, with its pace constantly growing, and a technological leap into a "new" economy, associated primarily with such technologies as microelectronics,

telecommunications, computers, robotics, creation of new materials with prescribed properties, biotechnology, nanotechnology being at its base. The specialists of the Spanish Institute of Perspective Developments and Technologies (TPES, Seville) based on the analytical research of highly developed countries of the world distinguished such perspective directions of technological development in XXI century as information technology and communications, green technologies, power engineering, automation of production, transport, new materials, health protection.

Research of BRICK countries, conducted by Intellectual Property & Science Department of the Thomson Reuters Corporation, deduced that each of these countries had its own unique features concerning innovative and technological development. Thus, South Korea is more known in computer science researches, Brazil focuses on agriculture developments, India - chemical industry, pharmacology, and software (Table 3).

Table 3

Main fields of R&D funding for five BRICK countries (as percentage of the world amount)

Country	Field of science
Brazil (2,6)	Agricultural Sciences – 8,8; Plant & Animal Science – 6,6; Pharmacology & Toxicology – 3,7; Microbiology – 3,3; Environment & Ecology – 3,0; Social Sciences – 2,8; Clinical Medicine – 2,6; Biology & Biochemistry – 2,6; Neurosciences – 2,6 Immunology – 2,5.
Russia (2,4)	Physics – 7,3; Space Science – 6,8; Geosciences – 6,6; Mathematics – 4,7; Chemistry – 4,5; Materials Science – 3,1; Engineering – 2,1; Molecular Biology – 2,0; Microbiology – 1,7; Biology & Biochemistry – 1,6.
India (3,4)	Chemistry – 6,4; Pharmacology & Toxicology – 6,1; Agricultural Sciences – 6,1; Materials Science – 5,9; Microbiology – 5,1; Physics – 4,3; Engineering – 4,1; Plant & Animal Science – 4,0; Geosciences – 3,7; Biology & Biochemistry – 3,6.
China (11,0)	Materials Science – 24,5; Chemistry – 20,2; Physics – 17,9; Mathematics – 15,7; Engineering – 14,8; Computer Science – 13,1; Geosciences – 12,3; Pharmacology & Toxicology – 10,1; ; Environment & Ecology – 9,8; Biology & Biochemistry – 8,8.
South Korea (3,3)	Materials Science – 6,3; Computer Science – 5,6; Engineering – 5,1; Pharmacology & Toxicology – 4,8; Physics – 4,7; Microbiology – 4,2; Chemistry – 3,7; Agricultural Sciences – 3,4; Clinical Medicine – 2,8.

Source: [11].

The analysis of the developed countries allowed to select priority areas of innovative and technological development (Table 4). As we can see, the greatest

attention is paid to nano- and biotechnology, raise of ecological production, information and communication technologies, search for alternative forms of energy.

Table 4

Priority directions and industries of innovative development of the countries with developed economies

Country	Priority directions and industries of innovative development
UK	Medical technologies, biomedical materials and fabrics, renewable energy, nanoelectronics, communications infrastructure protection, new materials, biotechnology, intelligent control systems, rational nature management, environmental technology-intensive services, new productive technologies, oil production sphere, applied information technologies, electronics, facilitation of construction materials.
Italy	Automobile construction, electronics, aerospace industry, metallurgy, chemical industry, agricultural sector, environmental protection.
Canada	Aerospace industry, agriculture, automotive industry, development of oil sands.
Germany	Energy, including energy saving, restoration forms of energy, environmental protection, health protection, national security, car making, shipbuilding and aircraft construction, biotechnologies, nanotechnologies, new materials for the production.
Norway	Information and communication technologies, biotechnologies, new materials, nanotechnologies.
USA	Defense, space exploration, aviation and space technologies, orbital station, energy, new clean coal combustion technologies, computer technologies, health protection, development of facilities of fight against AIDS, national critical and dual technologies, agriculture, transport, prevention of terrorist threats, environmental issues and climate changes, lasers and biotechnologies.
Finland	Energy, environment protection, engineer, forestry, health protection, information and communication industries, metalproduction.
Sweden	Information and communication technologies, biotechnologies, modern and ultramodern technological processes, developments in materials science and transport, newest trends in inter-branch and interscientific researches.
Japan	Biological sciences, researches of space and ocean, energy, new types of energy, domestic and medical electronics, information and of communication technologies, nanotechnologies and natural science, environment protection, production technologies, production of industrial robots, infrastructure, integrated circuits, new metals and ceramics, optical fibers.

Source: [20, p. 160 - 162].

Conclusions. Thus, we can draw certain conclusions about the changes which occur in today's global economy. Technological globalization has led to the formation of the main centers of R&D concentration and development, namely the United States, the European Union, Japan, and a group of developing countries, particularly BRICK countries. Leader countries are gradually losing their positions, and against this background one can observe the growth of highly competitive economies in the

newly industrialized countries, which, due to the presence of highly qualified and rather cheap labour force, corresponding infrastructure, an effective state policy of development of scientific research sphere and implementation of its results in the production, grow into new innovative economies.

The economy of the world will never return to the previous state of being "pre-informational". Now, a new knowledge economy is being formed. Newly industrialized countries, using their own competitive advantages and effective state policy in area of bringing in foreign investments, become global producers of new technologies.

These challenges of globalization are forcing states and companies to constantly develop their national innovative systems. And despite the economic crisis, investments in R&D are reduced neither by the states nor by the private sector. A crisis is always an incentive to look for new production methods. Innovative technologies tangibly reduce costs, while increasing profits.

In the global arena there are changes that lead to the formation of polycentric system of international relations. And the gap between developed countries and newly industrialized countries gradually reduces.

These new vectors of technoglobalizm can entail fundamental changes in international relations as a result of the formation of new centers of global economic competition. Newly industrialized countries are not only actively taking foreign transnational capital, but also develop their own transnational structures which are competitive in the world markets owing to the active use of innovative technologies.

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