OPPORTUNITIES OF ECONOMY INNOVATION DEVELOPMENT MAPPING OF RUSSIA

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Abstract. The present-day world economy is an integrated organism with a number of closely related macroeconomic processes. It is a dynamic system going through cyclic development and permanent restructuring of its institutes. The progress is achieved through innovation activities in all spheres of economy, making it possible to suggest an important role of innovations in the development of countries and regions. The article analyzes the ways of differentiation of advancement indicators in science and technology. The main parameters include the factors of science, financing of research and design, technical equipment and communication structure. Both Russia's regions and foreign countries are analyzed simultaneously providing for a number of interesting comparisons according to the territories' development level.

Since the 50-s and the 60-s of the last century intensification of the economy of developed countries was mainly due to the progress of science and the development of new technologies. Scientific support of production processes has risen to reach about 10% of production volumes in some industries. At present there could be no production without constant presence of a scientific factor inside it. Integration of science and technology into production has imparted the innovative character to the economic progress in general.

If the evolution of economic systems of the developed nations is analyzed for the last 40 to 50 years the most remarkable factor would be the impressive impact of science and technology on the economy. These countries have already entered a new, post-industrial stage of functioning which symbolizes creative participation of humans in the economic and social dynamics with the account of environmental and political restrictions to the consumption of natural resources.

Scientific and technological shifts have become a permanent phenomenon of the current economic development. They often take the form of an all-round change of technology. It was no accident that common notions of "development of techniques and technology" and "scientific and technical progress" were recently replaced by "the progress in science and technology".

At present the development of economic potential of a country and its competitiveness at the world's market increasingly depend on the innovation activities and the factor of science and technology development and application of scientific and technical achievements. Innovations based on fundamental research could become a real means to solve a number of global social problems and prevent the majority of adverse environmental effects of human activities.

The global experience of recent decades suggests that the concepts of competitiveness could radically differ depending on the relation of technological

structures associated with a certain level of productive forces development. Predominantly extensive type of production operates with criteria of costs, prices and quality. The intensive, or innovative, type of production applies quite different criteria, such as absolute novelty of products or possible terms of their mustering by competitors. However, the competitiveness is in any case controlled by innovation activities, which could take diverse forms, such as gradual improvement of goods' quality, transition to the advanced techniques or expansion of their types within the single system quality.

To describe the degree of innovative economy development for a certain country using some qualitative or quantitative characteristics a particular method of evaluation and a system of parameters are required. Measurement of such parameters is a complicated problem, primarily because of the very nature of the object under study. Innovations could hardly be measured quantitatively, in direct relation to social and economic factors.

In this case, the most efficient model is that analyzing both input and output parameters. The input ones could include the GDP percentage of research and design expenses, number of scientists and engineers, particularly Ph.Ds and D.Scs, in research and design sphere, provision with personal computers and the Internet access. Output parameters include the percentage of high technologies in the total industrial export, number of patent applications, amount of scientific publications, etc.

Of particular importance is the analysis of competitiveness which is the main target and the main incentive of innovation activities. Evaluation of more than 300 parameters of competitiveness provides rather objective assessment of the technological level of a country's economy. Recent statistical data allows the integrated assessment of competitiveness of several countries at the world market. The results of the rating studies are given in Table 1.

Table 1. Rating of the countries' competitiveness

Countries	Comp99	Comp98	Comp97	Comp96	Comp
Singapore	1	1	1	1	3
United States	2	3	3	4	1
Taiwan	4	6	8	9	1
Canada	5	5	4	8	2
Switzerland	6	8	6	6	3
Luxembourg	7	10	11	5	2
United Kingdom	8	4	7	15	2
Netherlands	9	7	12	17	2
Ireland	10	11	16	26	1
Finland	11	15	19	16	2
Australia	12	14	17	12	3
New Zealand	13	13	5	3	5
Japan	14	12	14	13	4
Norway	15	9	10	7	4
Malaysia	16	17	9	10	4
Denmark	17	16	20	11	4
Iceland	18	30	38	27	2
Sweden	19	23	22	21	2
Austria	20	20	27	19	4
Chile	21	18	13	18	4
South Korea	22	19	21	20	4
France	23	22	23	23	3
Belgium	24	27	31	25	2
Germany	25	24	25	22	4
Spain	26	25	26	32	2
Portugal	27	26	30	34	1
Israel	28	29	24	24	4

Mauritius	29	-	-	-	-
Thailand	30	21	18	14	5
Mexico	31	32	33	33	1
China	32	28	29	36	2
Philippines	33	33	34	31	4
Costa Rica	34	34	43	28	4
Italy	35	41	39	41	2
Peru	36	37	40	38	2
Indonesia	37	31	15	30	4
Hungary	38	43	46	46	1
Czech Republic	39	35	32	35	4
Jordan	40	34	43	28	4
Greece	41	44	48	39	4
Argentina	42	36	37	37	4
Poland	43	49	50	44	2
Turkey	44	40	36	42	4
Slovakia	45	48	35	-	4
El Salvador	46	-	-	-	-
South Africa	47	42	44	43	4
Vietnam	48	39	49	-	2
Egypt	49	38	28	29	4
Venezuela	50	45	47	47	4
Brazil	51	46	42	48	4
Ecuador	53	-	-	-	-
India	53	50	45	45	5
Colombia	54	47	41	40	5
Bolivia	55	-	-	-	-
Bulgaria	56	-	-	-	-
Zimbabwe	57	51	51	-	5
Ukraine	58	53	52	-	5
Russia	59	52	53	49	4

Notes: First four columns give the rank of a countries for the given year. The fifth column presents the changes of rating during 1996-1999: 1 – stable growth, 2 – growth with declines, 3 – no changes, 4 – decline with periods of growth, 5 – stable decline.
Source: World competitiveness report, Press release, 2000.

The corresponding database was used to compile a series of world maps representing such parameters as a number of scientists and engineers engaged in research and design per 1000 inhabitants, GDP percentage of science expenses, research and design expenses per 1 scientists or one inhabitant, percentage of high technologies export, number of application for patents from residents and non-residents per 100 000 inhabitants or 1000 scientists, number of scientific publications per 1000 inhabitants or researchers, number of personal computers and Internet stations per 1000 and 10 000 inhabitants respectively, rating of competitiveness of the countries and share of human capital in the total wealth.

The above-mentioned statistical parameters have a certain correlation between each other and could serve as a basis for classification of countries according to their innovation potential (high, medium and low). For example, the Nordic countries, Japan and the USA are the most prominent, particularly in some indicators. The USA and Finland have more then 1000 Internet stations per 10 000 inhabitants; in Norway there are more than 700 stations and about 500 in Sweden, while in the rest countries there are less than 400 stations per 10 000 inhabitants. Japan has about an order higher per capita number of patent applications from the residents as compared with its major competitors. On the other hand, there is practically no innovation potential in a number of countries of Africa, Latin America or Asia, some of them having zero values for many of the indicators.

The above-mentioned considerations make the proposed system of the innovation potential assessment suitable for about one third of the world, at least at present. Besides, there are no necessary data at all for about half of the countries of the world. However, the study does not become less interesting and useful. It makes it possible to understand, how the West European countries, such as Sweden, Denmark and Finland, as well as Japan, keep very high competitiveness of their products without necessary natural resources and cheap labor, and why several countries, including Russia, with enormous resource potential produce very little amounts of goods that are in demand at the world market.

Considerable differences between the industrially developed and developing countries could be explained by a number of non-innovation factors, such as political, social or production. Comparison of developed countries could be based on the parameters of innovation activities. Progress in the innovation sphere becomes clear through the analysis of the international trade in industrial products (percentage of high technologies export). It is interesting to note that the mutual supplies of highly technological products increase in one third most developed countries of the world.

The complex analysis of all data shows that in many countries the majority of input parameters could be rather high with only one of them quite different. This structure allows to suggest quite safely that the efficiency of the innovation sector is low. Ineffective use of resources is typical for the case when one parameter is much greater the other ones, for example, very large percentage of researchers and designers in Russia in parallel with inadequate financing and technical equipment. However, the overall rise is much easier to achieve in the countries with such distortions in the innovation sphere, because it is necessary to finance just one or several resource units, not all of them.

The advantages of competitive markets for increasing the economic efficiency and providing for the innovations are well-known and almost all countries try to use them in their efforts to stimulate the growth of economy. However, the experience of transition countries shows that the well-operating competitive markets could not appear at once, but they need good social infrastructure, as well as the institutes opposing the negative market forces. Relations between competitiveness and innovations are therefore complicated by a number of institutional aspects, which are also not easy to describe quantitatively and characterize in the cartographic form. Generally one may say that the set of above-mentioned parameters could be analyzed in complex only if there are stable and efficient political structures present in a country.

A positive aspect of mapping was the utilization of data for both 1997-1999 and a number of previous years. The resulting dynamics maps make it possible to trace the 10-15-year changes of parameters under study, describe new leaders appearing in one and the same sphere or the level reached in new spheres.

There is, however a question about the innovations in Russia against the background of the global situation. Today the following statement is true to this country: “Innovations for revival rather than for the economic growth”. Within the world’s economic space Russia is now a poor cold country oriented towards the export of raw materials. Russia accounts for less than 2% of the global gross product; the productivity of labor and the level of per capita income are several times lower than in developed countries. More than 2/3 of its territory lies in the zone of permafrost. According to the data of the Institute of social and political studies of the Russian Academy of Sciences, in 25 major parameters Russia has reached critical

levels which are considered to be catastrophic in the world's practice. More than 35% of the country's population have the income below the subsistence minimum.

Under the current state of Russia's economy the scientific and technological progress may seem to be an bizarre and untimely challenge. During 1991-1998 official documents and programs were practically free of mentioning the innovation sphere. The spectrum of interests of our policy-makers, businessmen and scientists is far from including the scientific and technological progress among the priorities. Statistical and research data prove, that during the period of reforms the whole set of prerequisites for science development has even worsen. Allocations for science and education reduced, as well as the investments into technological modifications of the economy. In 1991 financing of research and design activities accounted for 1.03% of the GDP; then it was 0.57% in 1992, 0.52% in 1993, 0.47% in 1994 and 0.41% in 1995. During the same period this indicator was about 2.6 to 2.7% in the USA and from 2.7 to 3.1% in Germany, Great Britain, Japan, France and Israel. Decrease in investments and deformation of the system of values in the society has caused the collapse of research organizations and forced the scientists to enter the spheres where neither their special knowledge or skills are required. The whole system of research and engineering organizations and their administration is radically changing in a number of branches.

The need to evaluate the national potential and choose the development scenario has led to the elaboration of an information system, which could be useful in the process of formation of efficient economic institutions. The principal task was to develop regionally differentiated approach to modernization of production, transformation of social and economic institutions, and growth of scientific potential. A series of maps was the first result of the system implementation. However, the system is designed not only for mapping but for the comprehensive evaluation of development scenarios and producing recommendations on management in the innovative spheres of the economy. In the future it can be transformed into a full-scale system of decision-making support.

Data for mapping were taken from the publication of the State Committee on Statistics "Regions of Russia". Its section on Science and Innovations includes many characteristics of the staff potential of science, expanses on science and innovative production for a number of years (less than 8 – 1991-1998). At the first stage the initial absolute data were related to regional population, number of research staff, as well as with the same data for other periods of time, thus increasing the reliability of compiled maps, which were supplemented by graphs and tables, mainly to describe temporal changes.

The information system verified a number of characteristic features of Russian regional differentiation and revealed the peculiarities of individual regions. The wide scatter of values come primarily to the attention, which is typical for the sphere under study, as well as for social and economic spheres as a whole. The analysis of results could be interpreted for the evaluation of the innovation potential of Russian regions.

Several dozens of parameters were analyzed. The resulting series of maps could be divided into blocks. For the sake of easy usage the following groups could be distinguished describing:

a) staff problems of the Russian science;

b) financing of science and innovations, volumes of innovative production;

c) organization structures and relations in the innovative sphere.

The database is compiled for both the regions of Russia and the countries of the world. Correlation of similar or identical parameters for the both levels under study makes it possible to estimate the position of Russia and its regions in the global innovation activities.

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