Bohdan Nina, Professor
Dean at Belarus State Economic University (Minsk, BELARUS)
bohdan@bseu.by

Open model of innovation: How Belarus responds to the world trends of development

Abstract

The problems of forming the indicators of innovative development are considered in this article in terms of changeable model of innovative process. The comparative analysis of parameters is made in regard to the statistics of Belarus and the countries of the EU, OECD, the direction of improving indicators are offered for illustrating the institutional establishing national innovative system of Belarus in open model innovation.

Transformation of the innovation process models

Till 1980-s researches of innovations were only in the formation of new knowledge, measured by investments in R&D, publications, patents and number of researches. The dominant idea was suggestion that R&D financing is assumption of technological inventions. The innovation theory was based on linear models of innovations where expenses on scientific research and developments create publications and patents.

In the end of 1980-s rethinking of Schumpeter's theory led to creation of modern innovation theory based on wide meaning of innovations. J. Schumpeter distinguished inventions and innovations, connecting the latter with commercialization of new products and implementation of new processes. Such definition of innovations has two distinctions from innovation model moved by scientific researches. First of all, inventions must be tested by the market with a view to economic development, what *supply for innovations makes the key factor of innovation process*. Secondly, companies can be considered as creating innovations if they do limited or insignificant creative efforts, for example, buying new technologies. As a result, required information to describe the outcome of innovation activity as diffusion and adaptation of new products or growth of productivity of

existing technological processes. The problems accrued, namely: determination of major innovation processes power, development of innovation strategies for companies to connect inventions (or technological adaptation) and needs of the market. Institutional environment becomes crucial for realization of modern innovations potential. This model of innovations determines as *integral or systematic*. [1, 2]

In the beginning of 21st century *"open model of innovation"* formed, what was determined by globalization of R&D, multidisciplinary format of innovations and modern business models [3, 4]. The main idea of such innovation model is that modern enterprises cannot rely on their own efforts for a long period of time, as internal ideas should be combined with external sources of knowledge.

Methodology of research

The new model of innovation process demanded changes in statistical observations. In the international researches Oslo Manual is used, being the basement of statistical observations in OECD and EU countries – Community Innovation Surveys-CIS. The national statistics in Belarus is considerably determined by the requirements of this standard, what gives an opportunity to make international comparison of innovation activity in Belarus and developed countries. We have used the statistics of EU countries according to the Statistic Innovation Survey-CIS-4 compiled every three years, and the national statistics (form 1 "Innovation") compiled annually.

Availability of the extensive statistical information that characterizes full spectrum of enterprises innovation activity allows creating mechanisms of policy, which take into consideration features of modern innovations. Consequently, realization of the Lisbon EU strategy demanded from European countries fundamental change of the information about innovation processes.

The European Union, including its new members, assesses innovation processes on the basis of 25 indicators and makes a benchmarking one of the most important policy decision instruments. For composition of the Trend Chart [5] both

regular data (Community Innovation Survey) and sampling observation are used. All European Innovation Scoreboard (EIS) [6] indicators of the last years are classified to 5 groups, which divide into 2 main categories according to "input-output" methodology. Classification of indicators as input and output allows determining of leading countries in different innovation activity changes and output-results ratio in all EU countries. 25 indicators are the basements for Summary Innovation Index (SII) of the country. EIS 2008-2010 amended and includes 29 indicators are arranged into three parts: Human resources, Firm activities and Outputs.

The Republic of Belarus is not yet ready to be characterized according to the full range of EIS indicators. Our settlements show that only 7-8 indicators could be compared with the European data. Statistical statements of Belarus represent *input* innovation: R&D intensity and human resources for innovation development. Taking into account the indicators of innovation activity *output*, the export of high-technology products can be compared (Belarus has 2-3 per cent of total export, EU – 16,7 per cent).

New indicators of innovation activity developed by UNU-MERIT for EIS 2008-2010[7], illustrate open model of innovations in a greater degree. First of all, it concerns the new part "Throughputs", where the new indicator *Technology balance of payments (in per cent of GDP)* was implemented. However, the possibility to assess the efficiency of a difficult innovation activity faces the numbered quantity of indicators, which describes such factors of innovations as diffusion of technologies, organizational innovations, entrepreneurship, conditions of demand for innovations.

Additionally, the national innovation system depends on system factors, such as mobility of human resources, commercialisation of scientific researches sponsored by the budget. These factors are very important as they provide long-formed links between different elements of the national innovation system, what becomes crucial in the terms of existence of system and open models of innovations.

Described problems are common not only for Belarus. These problems are usual for the countries forming the economy of knowledge and trying to find indicators of complex processes accruing in modern society. We have analysed the

European and national statistics information, describing the tendency to open model of innovation, to develop new directions of innovation policy.

Indicators of innovation process and results of innovation activity

The policy, taking into consideration features of modern innovation process, needs the information to characterize four aspects of innovation activity [5]:

– supply of knowledge, especially by financing of R&D;

– diffusion of innovations, giving the possibility to form links between creation of knowledge and its application;

– demand for innovations;

– networks and innovation clusters.

Excluding supply of knowledge, each of three other aspects of innovation activity has a lot of disadvantages and missed indicators. *The diffusion of innovation processes* is realised in two spheres, namely: successful adaptation of new technologies by companies and state sector (diffusion of knowledge through new technologies and new products – "explicit knowledge"), and diffusion of knowledge providing potential for the efficient implementation of new technologies ("implicit knowledge"). The indicators, describing education development and educational potential of innovation development, generally disclose diffusion of implicit knowledge.

It should be stated that the indicators of education (the proportion of third stage educated people, youth with completed secondary education, the proportion of graduates in natural sciences and engineer education) mainly describe the possibilities of enterprises to hire personnel with potential. It gives the opportunity to use new technologies, but does not show "absorbent possibilities" of enterprise to conceive innovations. This is confirmed by the fact that Belarus has high educational level of employees (the proportion of third level educated people is 40 per cent, almost twice higher than average European level), but the level of innovation activity in industry is only about 16-18 per cent.

To our point of view, the diffusion of knowledge processes can be estimated by the next ways. Firstly, as correlation of internal and external *sources of information* for innovations, which are determined by enterprise as "principal". Comparing CIS-4 [9] data with the information of statistical observation of Belarus enterprises innovation activity, we can conclude that the internal sources of information for innovation activity are less important. Production, marketing and research departments of enterprises are principal for 18 per cent of EU enterprises and 14,3 per cent of Belarus enterprises, respectively.

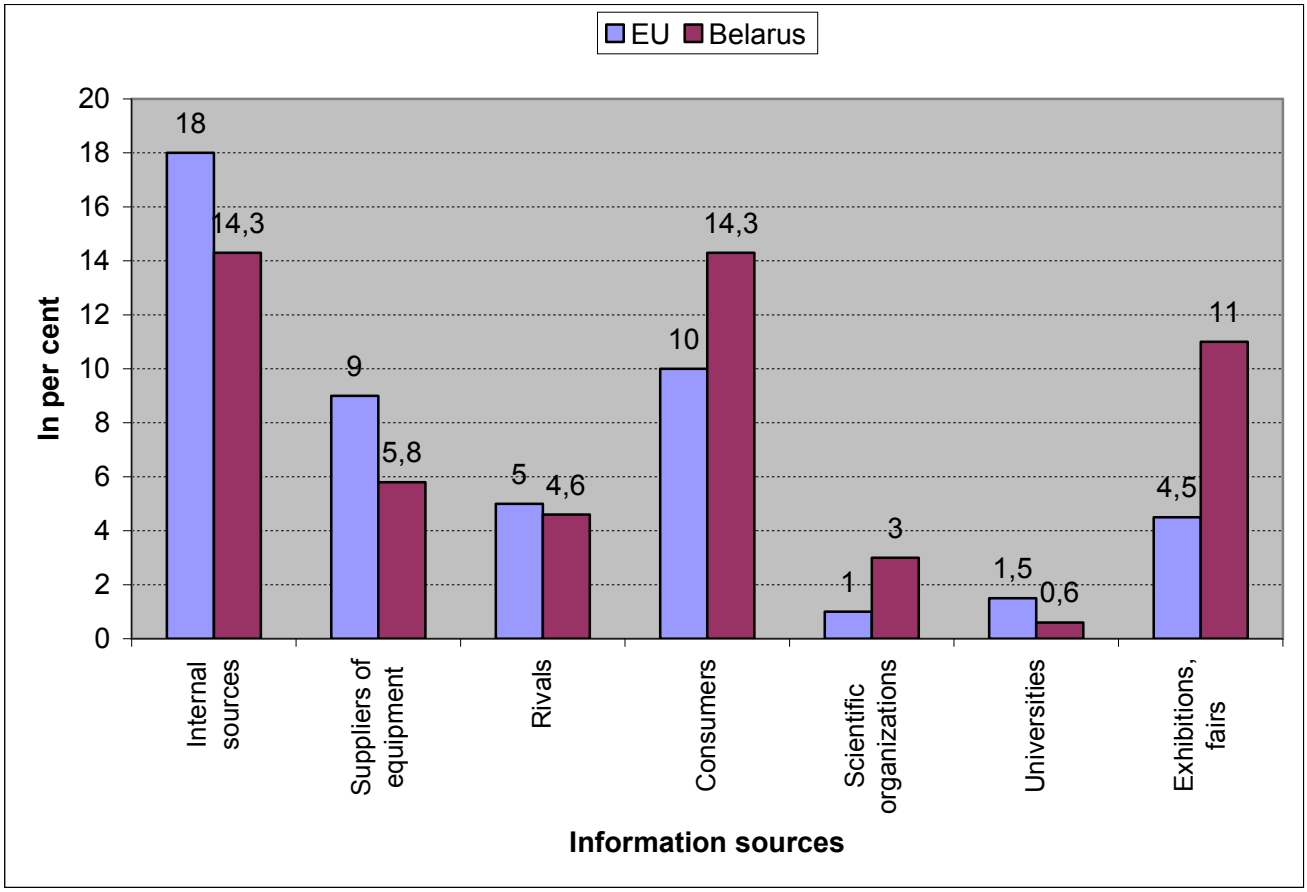

Figure 1. Comparison of the information sources of innovation, assessed as "principal" in Belarus and EU countries, in per cent of investigated enterprises (data of The Ministry of Statistics of the Republic of Belarus and CIS-4 data).

Analysis of this data allows making a conclusion that among external resources (suppliers, consumers, scientific organizations, universities, exhibitions, fairs), such as suppliers, rivals and consumers are really important for innovation activity (for example, EU – 24 per cent, Belarus – 24,7 per cent). At the same time, research institutes and universities are represented as "principal" in small percentage (EU –

2,5 per cent and Belarus – 3,6 per cent). This information confirms the idea that *both in developed countries and Belarus innovation process get under way of the linear model, moved by scientific researches, and now is realized as integral process*, where users and consumers play very important role in innovation development.

Secondly, being principal the information of statistical observation about innovation activity can be used for the assessment of diffusion of innovation. For the firms, studying *new products*, an effect from innovation activity is showed through enhancement of products offer, maintenance and extension of markets, quality improvements. For the firms, adapting *new technologies*, a result of innovation activity is showed through wage cuts, cuts of expenses for material and energy, reduction of environment pollution.

Analysis shows that the innovation products figure is considerable: 38 per cent of innovative EU enterprises consider "improvement of product and service quality" as quite important result of innovation activity. Comparable result was discovered in Belarus (39 per cent). Enhancement of products offer is considered as the main innovation activity effect for 44 per cent of innovation enterprises in Belarus and 34 per cent of enterprises in the EU. Moreover, important result is the maintenance and extension of markets – it was considered as principal by 42 per cent of enterprises in Belarus and 29 per cent in the EU, respectively (figure 1).

According to the assessment of enterprises (both Belarus and the EU) less important are the results of innovation activity, determined by new technologies. Wage cuts and cuts of expenses for material are considered as principal effect in 18 per cent and 9 per cent of the EU enterprises, respectively. The same indicators are estimated in Belarus as 5,3 per cent for the former and 28 per cent for the latter.

Thereby, innovations are aimed on the savings on costs labour in Europe three times higher than in Belarus. The reason of such situation is basically low cost of national labour. Similarity of innovations processes in the EU and Belarus is in the fact that the idea of innovation development is based on new products rather than on improvement of existing technologies.

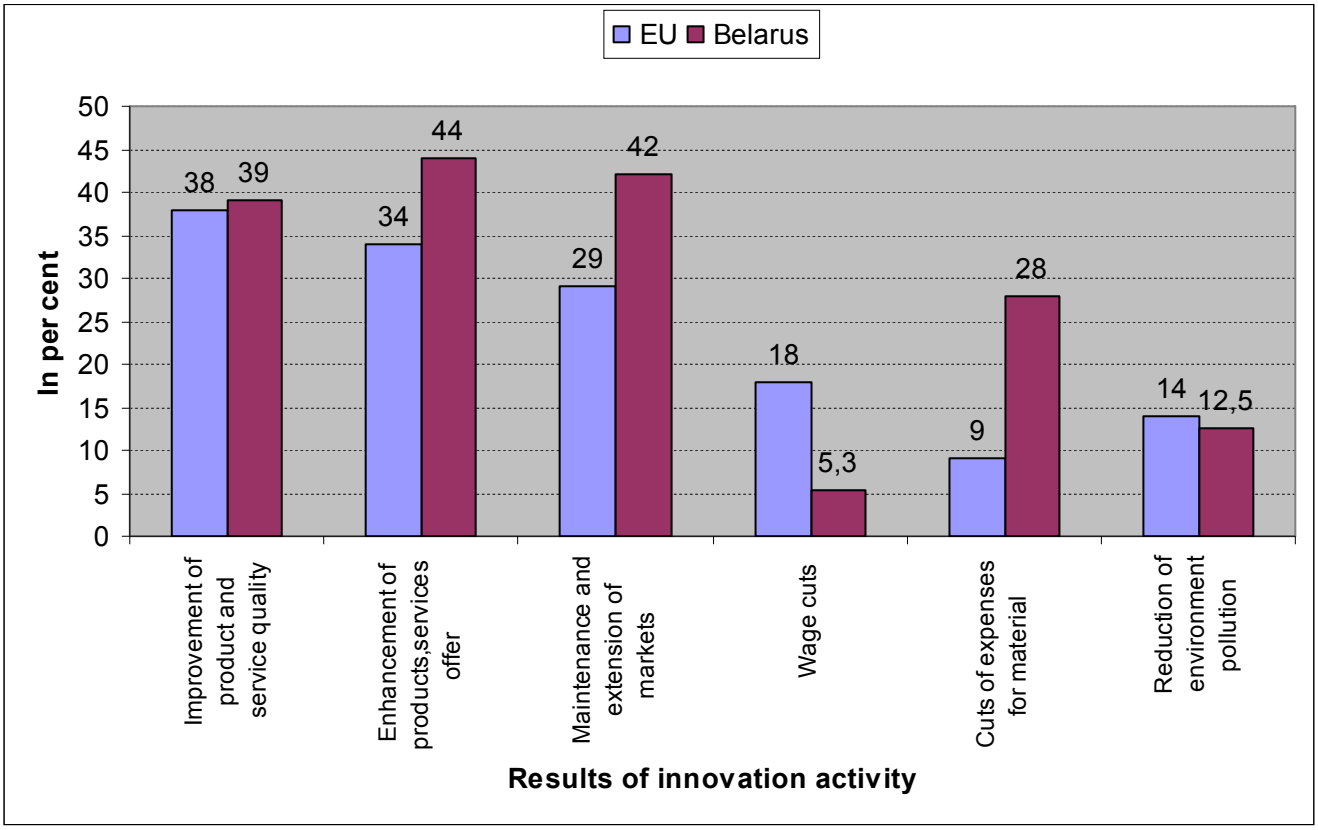

Figure 2. Comparison of innovation activity results, considered as principal in the EU countries and Belarus, in per cent to the total number of active enterprises in the sphere of innovations (data of The Ministry of Statistics of the Republic of Belarus and CIS-4 data).

The research shows that *diffusion of technologies* in innovation process takes leading position. Scientific-and-technical activity in enterprises and branches of Belarus economy is realized with the help of state scientific and scientific-and-technical programs fulfilment, direct economic agreements, and realization of branch-wise and factory reequipment plans, launch new products. 375 cutting-edge technologies were created in 2007 including new technologies in the country – 293 (78 per cent), new technologies abroad – 76 (20,2 per cent) and absolutely new technologies – 6 (1,6 per cent). This information illustrates that approximately 80 per cent of new technologies in the country are not new abroad. 74 out of 76 new technologies were produced in the state-owned enterprises and only 2 in the private enterprises, 68 technologies have patents.

Thereby, the research showed that diffusion of technologies takes leading position in the innovation development of Belarus. The country is generally an importer of technological knowledge. The most crucial in the innovation

development is state ownership; the intellectual property rights protect new technologies for the first time created for the market.

At the same time it should be accepted that the scale of international cooperation between Belarus and other countries in the sphere of science and technology is limited. The comparable information of technology balance of payments illustrates this situation (table 1).

Table 1 – Technology balance of payments (2003).

Country	Payments, bln. $ USD current rate	Receipts, bln. $ USD current rate	Payments, in per cent of GERD
Japan	4,862	13,043	3,6
USA	19,033	46,988	6,5
Great Britain	10,449	23,539	32,3
Canada	0,881	1,721	5,1
France	3,233	5,188	8,3
Norway	1,203	1,542	31,2
Finland	1,625	1,681	28,8
Germany	23,267	22,957	37,8
Switzerland (2004)	4,793	4,559	69,8
Italy	3,794	3,108	22,8
Portugal	0,742	0,401	64,5
Czech Republic	0,556	0,190	48,7
Mexico	0,608	0,054	21,9
Poland	1,044	0,246	94,3
Belarus (2006)	**0,05**	**0,006**	**20,4**

Source: composed by the author on basis of [13] and Belarus technological balance of payments.

The analysis shows that the leader on the technological inventions market is the USA as earned payments for usage of technological knowledge are 28 bln. $ higher than expenses. The leading countries in exporting of science and technology

knowledge are Japan, Great Britain, Canada and France. It could be seen from the table that Belarus has very low level of involvement into the global trade of scientific inventions. The country has 10 times lower level of payments rather than even Czech Republic. What concerns receipts (Royalty, licence selling), its scale hit minimal level in 2006 falling to 5,9 mln. Belarus in general imports technological knowledge. Many of new EU member-countries are importers of scientific and technological knowledge as well as Belarus, but their role on the market is much higher. Fulfilment of country's innovation development program and tasks of technological modernization objectively needs activation of this work. Belarus as the other pursuing development countries (Czech Republic, Poland, Mexico) have large share of technological payments to total expenses for the science. It also should be stated that the role of technological balance of payments is growing: 0,12 per cent of GDP in 2006, that much higher that in 2000 (0,013 per cent). But it is still significantly lower than in the developing EU countries (table 2).

Table 2. Technology balance of payments (per cent to GDP).

Country	EU-27	Bulgaria	Czech Republic	Estonia	Latvia	Lithuania	Poland	Romania	Croatia
TBP	1,07	0,25	0,39	0,22	0,16	0,08	0,4	0,22	0,52

Source: composed on basis of EIS 2008.

The research shows that even developed countries do not rely on only domestic scientific researches and technological inventions, what intensive work in the sphere of transnational knowledge flow needs. Firms have an opportunity to complete their own efforts in R&D by means of international market inventions. At the same time they can unite external knowledge flows with internal resources and competence for the provision of efficient innovation activity. Weakness is that Belarus interactive learning in global context is restricted not only by weak absorptive capacity but also by more and more ambitious global schemes to protect intellectual property.

Open model of innovation means variety of *financial sources* of innovation development. Own funds of enterprises prevail in the structure of financial expenses for innovations in Belarus (in 2006 – 77,8 per cent, in 2007 – 68 per cent). R&D

globalisation does not influence on innovation activity in Belarus, as the scale of foreign expenses for technological innovations was only 6,6 per cent in 2006 and 12,6 per cent in 2007 (including loans of foreign investors), respectively. At the same time there were no investments in R&D directly. Credit sources (bank loans) of innovation financing in the country were 5 per cent in 2006 and 9 per cent in 2007 (in per cent of innovation expenses). Limited number of financing sources influences on the scale of innovation activity and expenses structure.

If we analyse technological structure of expenses for innovations, we will see that the share of expenses for equipment purchase is about 45-48 per cent, R&D share – 23-24 per cent. To compare in the EU (according to the information of CIS-4) the share of expenses for R&D in total expenses is 46 per cent, or almost twice higher.

At the same time quantitative sample (structure of expenses for innovations in number of enterprises) shows that in Europe a half of active enterprises in the sphere of innovations make internal R&D expenses and 20 per cent buy external R&D products. The share of innovation enterprises that were doing R&D expenses in Belarus in 2007 is 44 per cent (168 industrial enterprises). Consequently, enterprises of Belarus in general make non-R&D innovations. Active enterprises in the sphere of innovations have 16 per cent in industry (medial and large business- more 100 employees). In the EU innovation activity of business (more than 250 employees) is 71 per cent of market, middle business (from 50 to 249 employees) is 53 per cent.

Retraining and education of employees for innovation development purposes plays very important role in the EU countries. According to the information of CIS-4 about 50 per cent of innovation enterprises realize training programs for their personnel, the share of such enterprises in Belarus was 15,1 per cent in 2004; 15,7 per cent in 2005; 14,9 % in 2006; 13,4 in 2007 (in per cent of innovation enterprises). This difference creates some difficulties in adaptation of new technologies and hamper innovation process in the country. The share of enterprises with marketing investments is twice lower in Belarus rather than in the EU (16 per cent in Belarus and 33 per cent in the EU). As a result, it has negative impact on the conditions of commercialisation new products.

The research shows that innovation process in Belarus still does not fall into a pattern of international tendencies in the sphere of open model of innovation creation. Enterprises, which receive state financing of innovation development, still reckon on continuation of such help. In the structure of financial sources of innovations budget share grew twice during the period from 2005 to 2006 – 12,3 per cent of total expenses, and was 10 per cent in 2007.

Economic factors such as lack of state financing and high prices of innovations are major obstacles of innovation development according to the survey of enterprises. This factor is important for the enterprises of the EU as well. Analysis has shown (figure 3) that 20 per cent of European innovation enterprises consider the lack of financing as the major obstacle for innovation development.

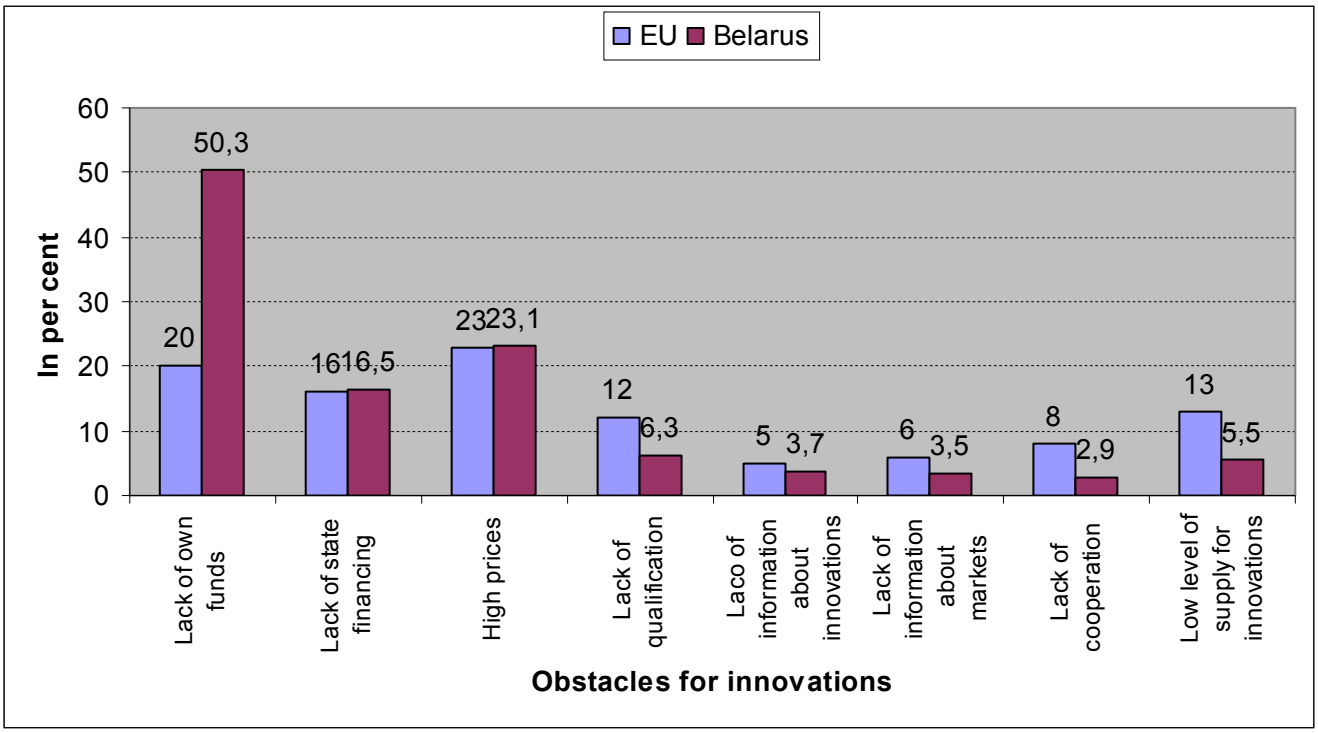

Figure 3. Hampering factors for innovations, as percentage of innovative enterprises.

The percentage of this enterprises is 2,5 times higher in Belarus, it is not surprising, as their own funds are the main sources of financing innovations, but the number of such funds is not enough for considerable innovative activity. Personnel of scientific innovative system are another barrier in terms of increasing innovations both for the EU and Belarus. There are 12% of innovative enterprises that consider

the lack of experienced personnel to be the main factor containing innovative activity while in Belarus the amount of such enterprises is two times lower.

Belarusian businesses undervalue the importance information about markets, new technologies, the necessity of collaboration and cooperation. It means that such factors of development as demand, interaction in the market of technologies seem to be inessential for the enterprises while they rely on government's support. Also small level of technological base, absence of the developed finance markets has negative influence and lead to vicious circle of backwardness.

The estimation of innovative activity's indicators and tasks of innovative development compatibility

Institutional environment is the main component of national innovative system. The researchers [2, 7, 8, 12] point out the role of construction for establishing effective national system of innovations. At the same time the main questions of estimating the level of institutions' development are not created yet [7, 10].

Probably entrepreneurship is the one of the most important powers in developing innovations and at the same time is the most difficult to evaluate. Entrepreneurship is supposed to be sensitive to the risk and also has the possibilities for reducing the risk, readiness to create new ideas, entrance to the market of capitals. There is the practice of estimating the level of entrepreneurship via the monitoring instrument such as Flash Eurobarometer in the EU. This instrument is able to define the preparedness to begin risky and new business in terms of financing.

Updated parameters EIS 2008 contain the level of entrepreneurship's development via the indicator "Firm renewal" that shows the ratio between the sum of number of births and deaths of SME and total number of SMEs. According to this indicator the leader in the EU is Great Britain – 10,3 percent, Lithuania – 9 per cent among new countries of the EU (the average level in the EU is 5,1 per cent). However, this indicator is not calculated by the Belarusian statistics. The level of innovative entrepreneurship can be defined with the help of another parameter "the

share of small enterprises in science and scientific service sphere". The dynamics of this indicator illustrate low attractiveness of the business in the sphere of science.

Table 3. Small entrepreneurship in Belarus.

Parameter	2005	2006	2007
The number of small enterprises, unit	33094	37660	51240
The share of small entrepreneurship in producing GDP, %	8,1	8,8	8,4
The percentage of small enterprises in the «science and scientific service» sphere	0,8	0,7	0,5

The source: the author according to the data of Ministry of Statistics makes the table.

It's necessary to admit that the government of Belarus applied the range of essential amendments in 30 law documents that are directed to improve the entrepreneurship climate. As a result Belarus found itself among first five countries-reformers of the year in the rating of World Bank "Business – 2009" and took the 85th place that is higher by 30 times in comparison with the previous rating.

The number of administrative setting and the cost of time and means for creating a business are reduced, the declaring principle of registration and liquidation is already launched and etc. These arrangements should positively influence the increase of the role of small business in Belarus and mitigate the consequences of world crisis.

The improvement of innovative indicators for the evaluating the development of entrepreneurship and innovative politics requires the data about forming "small separated" companies in terms of established organizations that is able to characterize the process of commercialization of R&D. Lately the output of high-technology innovative products was launched in spin-offs, created in the institutes of higher education. The volume of R&D expenses in universities of Ministry of Education in 2006 worked out 46,5 $ million [15]. There are 20 effective scientific and innovative enterprises, created in Belarus State University (BSU), Belarus National Technical University, Belarus State University of Information and Electronics that output advanced technology and import substitution products. In 2007 spin-offs of BSU produced the number of high-technology products equal to 4,5 $ mln. 30 spin-offs are

managed by National Academy of Science of Belarus and the turnover of outputted products worked out 570 $ ths. from 2006 to 2007. The ratio between the launched products and costs of R&D financed by the government is 15,3.

The indicator that shows the accessibility of the equity in the early stage of business is used for estimating the opportunities of effective entrepreneurship's activity. This parameter is equal to the percentage of portion of venture capital in GDP. Around the EU this indicator in average works out 0,107 per cent of GDP (EIS 2008), in particularly in Great Britain - 0,483 per cent of GDP, in Sweden - 0,287 per cent of GDP, in Finland - 0,163 per cent of GDP.

There are no venture funds in Belarus yet, however the process of creating them has just begun. Financial crisis and the absence of the developed small innovative business negatively influence this process. However, the liberalization of the economy started last year in Belarus, is able to contribute to the growth of venture capital's demand.

Innovation management is another problem of innovative development. The experience of many countries shows that the problem isn't triggered by the lack of ideas for creating new companies but the shortage of skilled managers for carrying out the scientific development from the invention to the commercialization. Still there is no such an indicator that is able to show the accessibility and quality of such management. The reports for World Economic Forum (WEF) contain the parameter of the quality of local management (Belarus is not included), but can't give the characteristics of supplement of high-quality management for innovative entrepreneurship.

In this case it will be rational to hold the pools among the Belarusian companies in order to get the data about the quality of teaching the innovative managers and the polls among the technical universities about the interest of students in getting the knowledge about creating innovative business basing on inventions. As an example, there is such a program called INNOBAROMETER in the EU [11].

Organizational innovations can be the key factor in providing both the growth of labor productivity and the possibility of the companies to get the maximum of

profit from product and process's innovations. The European statistical researches of innovative processes (CIS-4) show the three types of organizational innovations: the knowledge management, the organization of the work and the interrelation with other companies and scientific institute. The data of CIS-4 illustrate that 18 per cent of European enterprises have used the marketing innovations, 35 per cent - the organizational innovations and 41 per cent - both organizational and marketing.

According to the Belarusian statistics the share of enterprises made the organizational and managing innovations was 52 per cent among all the respondents in 2005 while in 2006 this figure was 63 per cent and in 2007 – 65 per cent of all industrial enterprises. Thus the portion of enterprises incarnating the organizational innovations is higher than the portion of enterprises doing technological innovations (14-17 per cent) in Belarus, while in the developed countries the organizational innovations are equal to technological. There are some changes in organizational innovations in Belarus. It is the use of modern system of controlling the quality of products in 2007 – 80 per cent of all enterprises that have incarnated the innovations. Another important matter is the marketing innovations – 52 per cent of the enterprises. These organizational changes allow improving the competitiveness of the products that is very considerable for the open economy of Belarus.

In our view for attending future researches they should create the indicator that illustrates the share of personnel involving in the process on innovating activity. This parameter is able to define the influence of organizational innovations on enterprises in the easiest way.

The demand on innovations is lighted in the modern statistics in a weak way. M. Porter pointed out in researches of competitiveness that perfect demand on innovative products is a considerable factor of innovating activity. The urgency of the demand on innovations for innovative activity of the EU was highlighted in the report of E. Aho [15]. Nevertheless sometime it's difficult due to the demand to explain the high efficiency of innovating potential of countries such as Sweden and Japan [5]. It is not reasonable to make the large amount of investing in innovations in Sweden, as there are not enough customers in internal market and in Japan as a lot of innovating

products didn't have the high potential of growth in the internal market. It's obviously that in the condition of open innovative model the problem is closely connected with the global market. Thus the state is called to stimulate the companies to enter the global markets but not to rely on the internal demand on the innovations.

By implication the level of the demand on the innovations can be defined by the investments in the updating the fixed capital, however, the use of it shows that all new equipments will contain the technological innovations but this is an inaccessible matter. Besides, the investments in fixed capital contain other elements, which do not always have innovative decisions.

According to the results of the researches of The Report about competitiveness of countries that was provided in the World Economic Forum (Davos, 2005) [8] it should be emphasized that the dependence between the inclination of the customers of the countries to the acquisition of innovating products and technologies and the composite index of innovating development of countries is significant (R2=0.73) [5].

The question "Are the customers in your country are the adaptive to the new products and processes?" might be answered by the managers of the countries with following variants "1 – weak, 7 – actively looking for new technologies and processes". The results illustrated that the indicator of the answers in Finland worked out 6,0; the USA and Sweden – 6,2; while this parameter is reasonably lower in the developing countries: in Bulgaria – 4, in Poland – 3,8. The results of these researches prove the true position of M. Porter and E. Aho that perfect demand in the internal demand is mainly the trigger of national innovative activity. At the same time, from the experience of the countries the potential of international markets should be used and it can contribute to the powerful innovative growth of the country.

The government as a customer of innovative products can support the important role in the forming the demand on the innovations via the system of government purchases. However, it is rather difficult to evaluate the quantitative role of public procurement in the sphere of stimulating the demand. The research made for WEF [8] illustrated that the correlation between the composite index of innovating development of country SII and index WEF, based on the estimation of

the government purchases for the innovative development, is significant (R2= 0.63) [5]. Index WEF is defined according to the poll of mangers "Government purchases of goods and services based on new technologies stimulate innovating activity", where the answer "yes" - 7, while "the purchases are defined exclusively by the price factor" - 1. The highest level of influence was among the countries-leaders of innovating development (Finland – 4,8; Japan – 4,9; Sweden – 4,6) that illustrated the important role of the government in forming the demand on innovations.

The management of innovating process that is held in the condition of open economy requires the presence of the system indicators, characterizing the connections and interrelations of different participants. For this matter the parameter was launched in Innovating indicator board. This parameter is equal to the share of SMEs which have agreement about the cooperation with other companies and institutes in the process of innovating activity [6, 10]. In average among countries of the EU the percentage of innovating SMEs that have relations with other participants of innovating system works out 9,5 per cent [10]. The leaders in Europe are the following countries: Finland-27.5 %. Sweden-16.6%, in new EU countries -Bulgaria-3,8 per cent; Romania – 2,9 per cent. There is no indicator that characterizes the process of cooperation and interrelation of SMEs in terms of innovating system in Belarusian statistics.

At the same time the process of interrelation might be analyzed via the parameters characterizing the acquisition and transfer of new technologies. In 2007 among 2135 industrial enterprises there are only 147, that acquired new technologies (7 per cent) including 86 enterprises did that abroad, it means that more than the half (58 per cent) acquisitions of technologies were hold abroad. The deliveries of the technologies were made by 34 enterprises (4 per cent) of industry sphere. Still only 9 enterprises exported technologies abroad, that means the superiority of technological import. The process of technological exchange in the economy of a country is still limited, that is connected with low rate of privatization and inflow of investments.

It will be rationally to use the data about *the mobility of scientists* for estimating the system of cooperation and interrelation of the participants engaged in

the innovative system of learning economy [2]. The mobility of scientists and academics of universities of higher education between the companies, countries, scientific centers and business provides the diffusion of knowledge and thus assists the support of innovative potential of a country. According to the report of Esko Aho [16] there is the task to provide 10 per cent of the exchange of scientific workers annually in the EU.

In Belarus 5319 researches worked abroad in 2007 that was 1,9 times higher than that of 2006, where 21 per cent among them fulfilled the combined programs and worked in the foreign companies that enriches the methods of researches and leads to the diffusion of knowledge. At the same time these contacts are short-term – 99 per cent of all trips were till 3 months and 0,2 % of researches worked more than 1 year. If to analyze trips through the types of companies the result will be that the most specific gravity is taken by the companies responsible to Ministries and other republican institutions – 40 per cent, the share of institutes of higher education is rather lower – 7,5 per cent, that influence the quality of modern education.

According to the international statistics of education [17] the mobility of students sharply increased in the countries of the world – annually more than 2,4 $ mln. of students move around the world, the growth of foreign students takes the lead position over the dynamics of other migration flows. In Europe the leader of the highest level of migrating students is GB – 364,5 thousand people, that is 16,2 per cent of all students, almost one third of them study natural scientific and technical subjects. Belarus is less engaged in the international exchange of students: the portion of foreign students of all students studying in the country is equal to 0,5 per cent that is lower than that of Kazakhstan (1,3), Russia (0,9), Ukraine (0,6). At the same time the number of Belarusian students is 2,1 per cent of all students abroad. They choose the following countries: Russia, Germany, Poland, France, the USA.

The main interest of the analysis of the knowledge flow is the mobility of the researches between science and business; however, this kind of parameters isn't calculated directly. It's obviously that the number of such moves won't be considerable if the government does not stimulate it. The cooperation between

business and science might be illustrated by the indicator characterizing the share of the researches ordered by companies in whole volume of costs spent on science in the colleges and scientific institutes. In the European statistics the indicator is used to illustrate the process of commercialization of researches – the share of companies received the financing means of government for innovations. In average in the EU [6] it works out 9 per cent. The leaders are Ireland – 27,8 per cent, Luxemburg – 39,3 per cent. The companies of Belarus got quite significant government's support via the scientific state programs, but unfortunately the statistics doesn't track the share of enterprises received the financing of the government for the aims of innovations that leads to the difficulties of estimating the efficiency of governments' support.

The open model of innovations requires the illustration of globalization in innovation process and diffusion knowledge in the statistics of the innovations. It will be reasonable to use the following indicators [5]:

- the share of BERD, fulfilled by the foreign subsidiaries of transnational corporations,
- the share of BERD, financed by the foreign sources,
- co- patenting by the researchers in different countries,
- co-authorship in the foreign scientific publications.

Conclusion

Both in developed countries and Belarus innovation process get under way of the linear model, moved by scientific researches, and now is realized as integral process, where users and consumers play very important role in innovation development.

Innovation process in Belarus still does not fall into a pattern of international tendencies in the sphere of open model of innovation creation. The scale of international cooperation between Belarus and other countries in the sphere of science and technology is limited. Enterprises, which receive state financing of innovation development, still reckon on continuation of such help. In the structure of

financial sources of innovations budget share grew twice during the period from 2005 to 2006.

The Republic of Belarus is not yet ready to be characterized according to the full range of EIS indicators. Our settlements show that only 7-8 indicators could be compared with the European data. Statistical statements of Belarus represent in the fullest extent R&D intensity and human resources for innovation development

The results of the researches show that contemporary parameters of the innovations do not illustrate the complex process of innovating activity that becomes the open innovative model in terms of globalization. The parameters of innovations as a rule show the costs and weakly illustrate the results of innovating activity and the conditions of its existence. The processes of globalization require the energization of country's participation in the global market of research products that includes the development of the measures:

– to harmonize the statistics of innovations of Belarus with the international standards of statistic observation of innovations, (OSLO manual, EIS)

– to carry out observations at a time (perhaps it will be possible with the help of international programs of the 7th frame program of the EU) that illustrate the innovating processes in the sphere of services, organizational innovations, innovating entrepreneurship, features of innovating management, rising demand on innovations.

From the point of view of developing the mechanisms of innovating policy the following direction should be highlighted:

– Improvements of holistic approach of the innovative policy (the interaction of R&D and innovative policy, the protective policy of intellectual property's rights, the policy of human potential's growth, the tax policy).

– Increase of absorbing capability of enterprises in getting new technologies (the support of technological knowledge flow by the government, enlargement technology balance of payments, attractiveness of foreign investments, forming the favorable entrepreneurship's climate).

– Stimulation of personnel mobility between the academic sphere and branches of economy, between the regions of the country and the enlargement of international scientific cooperation and interaction with the EU.

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