INNOVATION AS A GENERATOR OF SOCIO-ECONOMIC DEVELOPMENT

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ABSTRACT- *In spite of the positive social climate, personnel and material capacities for the development of innovative activities, the results in our country are not satisfactory. This indicates that there is a need to detect and remove the barriers which prevent faster development of innovative activities. Therefore, a quick and strong orientation towards the economy of knowledge and the development of technological and scientific capacities of the country is the only alternative for Serbia at the beginning of the 21st century.Modern innovative processes, due to their complexity, require training of staff for new jobs such as: professionals for marketing activities, patent engineers, lawyers and economists who will deal with innovation management and the introduction, protection, and application of intellectual property. By comparing the total average public and business R&D expenditures in the period from 2000 to 2009 (0.3% of GDP) and the total expenditures of other countries, it could be concluded that the innovative potential for commercialization of new products in Serbia is about ten times lower than the average in the European Union. This is far from the recommendations of the Lisbon Declaration, which suggest that it is necessary to allocate about 3% of GDP for encouraging technological development. Only one third of this sum should be from the budget of European countries, and two thirds should be enterprise investments in research and development. The success of a particular enterprise depends on their cooperation with other participants in the "innovation system", which involves participants from business sector, public sector and knowledge sector. The interconnection is crucial for the success of the Triple Helix model, and the relationship between enterprises and scientific institutions is particularly important.*
Key words: *innovation, innovation index, knowledge creation, patents, human resources*

1. INTRODUCTION

Knowledge-based economy represents a new economic environment where collection and management of knowledge have a predominant role in creating fortune in comparison with traditional factors of production such as land, workforce and capital. Namely, the 21st century is often referred to as a knowledge century where creation and application of knowledge have become the basic determinant of the global competitiveness of an enterprise and economy even more than it used to be.

Despite economic slowdown in recent years, the intensity of knowledge has continued to increase in the countries of the OECD, which assumes an increase in investment of private sector in research and development (R&D). Innovation can be defined as "a process which leads to the introduction of new products and services to the market, that is, implementation of a new method for making products or services. Moreover, an innovative concept can refer to technical advantages with respect to production or changes in the requirements related to development, promotion and sale of products and services" (Bobrovszky, 2002:27).

Article 2, paragraph 4 of the Law on Innovative Activity of the Republic of Serbia states that innovation is successful application of invention, that is, the implementation of a new or significantly improved product, process or service (including considerable improvements of technical characteristics, components and materials, installed software, customer orientation or other functional characteristics) or a marketing method or a new organizational method in business practices, work organization or the relation between a legal entity and the environment (Law on Innovation Activity,18/2010). Article 2, paragraph 3 defines invention as a concept, idea and method for obtaining a new product or process, including invention of new technology (for products or services) for exploitation of natural resourc es.

Knowledge and innovation management in enterprises and appropriate institutions is a way in which they use their innovative potential. Generating new knowledge generally assumes high costs. In the case of technology, costs are related to expenses for research and development (R&D)

whereas costs of copying or imitating are usually very low. Knowledge and innovation management represents a key factor which determines whether an enterprise will invest in innovation and to what extent it will manage to cover the costs of the investment and to make profit when research and development results are innovative products and processes.

The famous management guru, Peter Drucker, claims that business enterprise has two basic functions: marketing and innovation. Marketing and innovation produce results, all the rest are costs (Drucker,1993). These two basic functions enable realization and maximization of profit through the process of ensuring quality products and services for consumers.

Within the Program of Support for the Development of Small and Medium Enterprises (SMEs) and Entrepreneurship, financed by the European Union via the European Agency for Reconstruction, the European Innovation Scoreboard (EIS) has been made for the first time in Serbia. It is used to measure effects in the innovation field at a national level. EIS is a unique common index which summarizes separate indicators in order to embrace main drivers and sources of innovation: creation of new knowledge, knowledge transfer, human resources, financing production and market research, and aspects of innovative processes which could be influenced by certain measures of the government (state interventions). "Separate indicators are classified in four groups, each of which contains more elements. These are:

human resources for innovation, which are measured by the education level of the population, the share of higher and secondary educated people in the population and the number of employees in technological fields and activities;

creation of new knowledge, measured through public and private R&D expenditures, the number of high-tech patent applications and the share of patents in the total population;

new knowledge transfer and application, measured by the share of the implementation of innovations and innovative processes in SMEs, investments in innovation compared to the total investments, and the percentage of SMEs where innovations are not implemented and R&D investments are not made;

financing innovation, products and market; there are seven indicators which assess the share of technological capital in the total capital, the share of sale of new products in the market as well as products known in other markets, but new in the domestic market, the extent of the use of the Internet and expenditures for the introduction of ICT to enterprise's business" (Zarkovic, 2006:34).

In spite of the positive social climate, personnel and material capacities for the development of innovative activities, the results in our country are not satisfactory. This indicates that there is a need to detect and remove the barriers which prevent faster development of innovative activities. Therefore, a quick and strong orientation towards the economy of knowledge and the development of technological and scientific capacities of the country is the only alternative for Serbia at the beginning of the 21st century.

2. HUMAN RESOURCES FOR INNOVATION

The analysis of the structure of highly educated staff indicates the neglected development of technical staff, a lack of engineers, because students less and less opt for scientific courses of study. The data in Table 1 show that in Serbia, graduated professionals in scientific areas aged between 20 and 29 account for 6.7%, while the percentage in Bulgaria was 11.7%, in Romania 5.8%, EU25 11.5%, EU15 12.5%, USA 10.2% and in Japan 13%.

In addition, due to the fast development of science, technical knowledge, and technology, knowledge acquired at schools and universities is quickly becoming obsolete. It requires permanent, life-long education of staff during work process, continuous acquiring of theoretical knowledge, and transfer of the knowledge to technical and technological solutions which improve economic productivity. While the percentage of permanent education in the EU countries is 9%, Serbia has a low level of permanent education (4.1%). However, it gives greater importance to life-long learning than Romania (1.3%) and Bulgaria (1.4%). According to the employment in high-tech manufacturing and high-tech service sector, Serbia is ranked between the neighboring countries and the EU countries as it is shown in Table 1.

Table 1 EUROPEAN INNOVATION SCOREBOARD FOR 2009

European Innovation Scoreboard – human resources							
Human resources	Serbia	Bulgaria	Romania	EU 25	EU 15	USA	Japan
Number of researchers per 1000 active population	3.2		2.1	5.8			
Employees in R&D as % of active population	6.3		3.4	10.2			
Number of science faculty graduates (% of group aged 20-29)	6.7	11.7	5.8	11.5	12.5	10.2	13
Population with tertiary education (% of group aged 25-64)	17.3	21.3	9.6	21.2	21.8	38.1	36.3
Participation in life-long learning (% of group aged 25-64)	4.1	1.4	1.3	9.00	9.7		
Employment in medium and high-tech fields (% of workforce)	6.57	4.66	5.32	6.6	7.1	4.65	
Employment in high-tech fields (% of workforce)	2.59	2.69	1.45	3.19	3.49		

Source: The Innovation Scoreboard, 2009

Modern innovative processes, due to their complexity, require training of staff for new jobs such as: professionals for marketing activities, patent engineers, lawyers and economists who will deal with innovation management and the introduction, protection, and application of intellectual property. The data presented above were taken from the Innovation Scoreboard of the EU for 2009, while the data for Serbia were calculated on the basis of the data available at Statistical Office of the Republic of Serbia. According to the data of Statistical Office of the Republic of Serbia, there are 10,220 researchers, out of which 8,800 are engaged in projects of Ministry of Science and Technological Development.

With respect to age structure, average age of researchers is 44.3, which in comparison with the average age of population of 40.25 (according to which Serbia belongs to countries with old population) indicates that there is a need for creating and keeping young researchers, which depends on higher education policy. Currently, the highly educated account for 8% of the total population and they cannot ensure the development of Serbia (Strategy of Scientific and Technological Development of RS, 2010-2015). One of significant problems for maintaining and strengthening scientific community is that the highly educated are leaving the country. In the period from 1990 to 2000, 73,000 inhabitants left Serbia, out of which 17,000 had a university degree. Emigration has continued even after 2000, and about 50,000 have left Serbia, out of which there have been about 2,000 highly educated people (Strategy of Scientific and Technological Development of RS, 2010-2015). The most common reason for emigration of researchers is, apart from higher pay, better conditions for scientific and research work. The majority of the highly educated who left the country are in the field of technical and technological sciences (IT) and natural sciences. The reasons stated above indicate that it is necessary to change the policy of higher education, to introduce incentives for the best graduate students to stay and to make a long-term plan for returning researchers from the diaspora.

3. CREATION OF NEW KNOWLEDGE

In this analysis, an indicator which shows public and business—private R&D expenditures is especially emphasized, and it is evident that in this segment, we seriously lag behind the neighboring and EU countries. Moreover, there is a substantial disproportion between resources invested in scientific institutes and universities and the level of commercialization of these projects in economy. Namely, an indicator showing a real innovative potential of an economy is how much enterprises invest in research and development. Table 2 presents that in Serbia, business (private) R&D expenditures amount to only 0.06% of gross domestic product (GDP), in Bulgaria 0.1%, in Romania 0.23%, in the EU25 1.27%, in the EU15 1.30% , the US 2.03%, and in Japan 2.32%. The data for business (private) R&D expenditures was calculated only for the needs of the European Innovation Scoreboard (EIS) for 2009, considering that in Serbia, there is not a continuous annual evaluation of private sector investments in scientific and technological research.

By comparing the total average public and business expenditures of 0.3% of GDP in the period from 2000 to 2009 and the total expenditures of other countries, it could be concluded that the innovative potential for commercialization of new products in Serbia is about ten times lower than the average in the European Union. The total investments in science in Serbia do not exceed 0.5% of GDP, which ranks Serbia among the countries with the lowest investments in science both regionally and internationally (Graph 2). Additionally, this is far from the recommendations of the Lisbon Declaration, which suggest that it is necessary to allocate about 3% of GDP for encouraging technological development. Only one third of this sum should be from the budget of European countries, and two thirds should be

enterprise investments in research and development.

Table 2 EUROPEAN INNOVATION SCOREBOARD FOR 2009

European Innovation Scoreboard - creation of knowledge							
Creation of knowledge	Serbia	Bulgaria	Romania	EU 25	EU 15	USA	Japan
Private R&D expenditures (% of GDP)	0.06	0.1	0.23	1.27	1.3	2.03	2.32
Public R&D expenditures (% of GDP)	0.21	0.4	0.15	0.67	0.69	0.86	0.8
Number of high-tech patents applied for at EPO (per million population)		0.6	0.2	26	30.9	48.4	40.4
Number of high-tech patents applied for at USPTO (per million population)		0.1		9.4	11.2	76.4	75.4
Number of patents registered at EPO (per million population)		3.7	0.9	133.60	158.8	154.5	166.7
Number of patents registered at USPTO (per million population)		0.8	0.2	59.9	71.3	301.4	273.9

Source: The Innovation Scoreboard, 2009.

According to the number of applied, protected and realized patents and the development level of intellectual property system, our country is the last among OECD countries. This can be concluded by comparing indicators such as: an increase in population, economic development, investments in science, an increase in the number of institutes and other higher educational institutions, the number of highly educated population, master and doctorate graduates, researchers and research projects.

The ratio between registered patents and applied inventions indicates the quality of patent applications of domestic inventors. In the period from 2000 to 2007, the average ratio of registered patents to applied domestic inventions was 1:5.15 (19%) (Simin,2011). If we look at the period from 1945 up to now, there has not been a considerable improvement. On the contrary, there has been stagnation, which implies that it is necessary to encourage strengthening of relations between science, educational system and economy in order to improve the transfer of technology and knowledge.

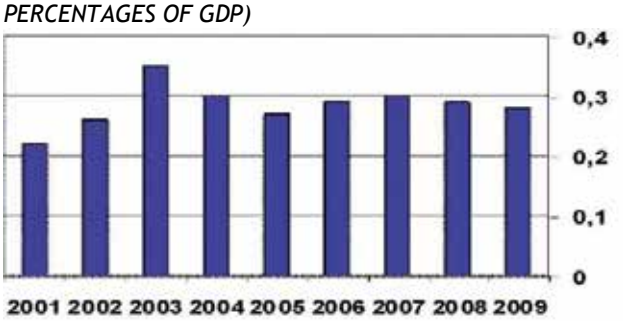
Moreover, the number of domestic invention applications in relation to the number of inhabitants in the country is relevant for evaluation of technological innovation in a country and its ranking among other countries. Considering that we were second from bottom (Romania was the last) according to the number of patent applications (57.6 per million population) in 2006, this proves years of systematic neglect and a lack of conscious innovative policy in Serbia (Kingston,Scally,2006).

It is necessary to define the legal framework for co-financing the program of technological development between the state and private sector with fair distribution of income from intellectual property for right holders of intellectual property. The state has to give a chance to domestic intellect by encouraging the development of domestic technology through various programs at different levels of government and public enterprises.

4. INVESTMENT IN THE FIELD OF SCIENCE IN SERBIA

Graph 1 illustrates budgetary investment in science in Serbia for the period from 2000 to 2009 in percentages.

Graph 1 BUDGETARY INVESTMENTS IN SCIENCE (IN PERCENTAGES OF GDP)

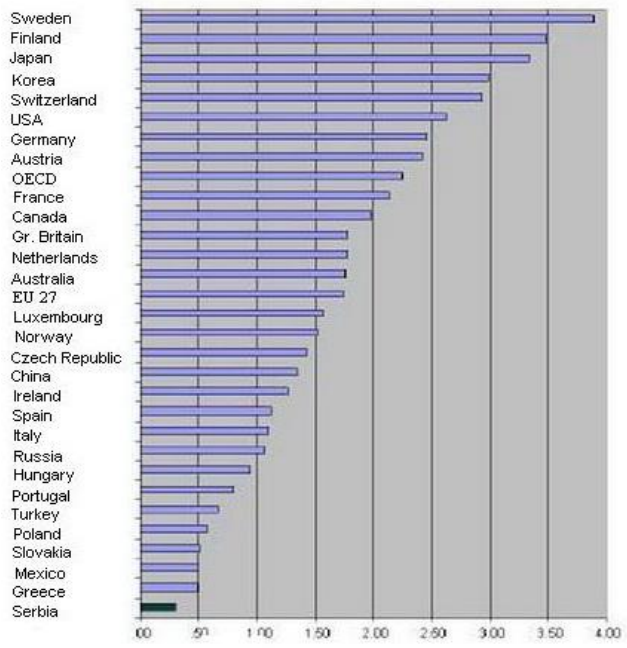


Source: Strategy for Scientific and Technological Development of Republic of Serbia, 2010-2015 (Law on Budget of RS)

We considerably lag behind developed countries. In 2009, expenditure on science in the USA was 2.6% of GDP, in Japan 3.3%, in China 1.3%, in Russia 1.1%, and the average in European countries was 1.84% (Graph 2). What is even more concerning is the fact that in this respect we considerably lag behind the neighboring countries, which all, except Albania, invest more than 0.5% of GDP, while Slovenia, the Czech Republic and Croatia already invest 1% of GDP.

In all highly and middle developed countries, investments in science are permanently increasing, and this trend has continued even in the conditions of the world crisis. Thus, the USA has announced they will double budgetary investments in science over the next ten years, while China increases its science budget by almost 20% every year (Rushing,2006)

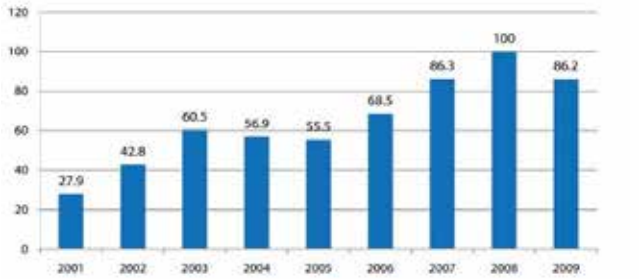
Graph 2: TOTAL EXPENDITURE ON SCIENCE IN PERCENTAGES OF GDP



Source: OECD Science, Technology and Industry: Scoreboard 2009

Gross budgetary expenditure on science in Serbia considerably increased from €28 million in 2001 to about €86 million in 2009 (Graph 3). If we observe the share of science in GDP, it amounted to a bit over 0.3% in 2003 and it was stagnating at that level until 2009.

Graph 3 BUDGETARY EXPENDITURE ON SCIENCE (€ MILLIONS WITHOUT NIP)



Source: Strategy for Scientific and Technological Development of Republic of Serbia, 2010-2015 (Law on Budget of RS)

The report of the European Agency for Reconstruction states that the predominant problem in this field is a lack of systematic links, that is, a need to facilitate linking institutions for research and development, universities, institutions for the development of intellectual property, government mechanisms of procurement, and infrastructural support for enterprises. The European Agency for Reconstruction has assessed that links between enterprises and scientific institutions have to be stronger in order to ensure the constant transfer of knowledge, innovation and skills in economy.

With this aim, in September 2009 the Government of the Republic of Serbia set out the national "Strategy for Scientific and Technological Development of the Republic of Serbia for the period from 2010 to 2015", which conveys a vision of Serbia as an innovative country where scientists achieve European standards, contribute to the total knowledge level of society and improve technological development of the economy. Its two key words are "focus" and "partnership". Focus because it is necessary to define the list of national scientific priorities where improvement can be achieved. Partnership because the development of science is not an issue of one ministry, but the whole society, and the fact that Serbia has to find partners in the field of science and economy, both in the country and international environment. "The strategy outlines the following national priorities:

- Raising awareness on the importance of innovation;
- A reform of existing scientific and research institutions aimed at increased focus on commercial application of research results and improving their capacities;
- Participation in international trends in scientific and research activities and knowledge exchange;
- Creating conditions for higher investments of public and private sectors (enterprises - SME) in research and implementation of innovations;
- Strengthening the links between science, educational system and economy in order to improve transfer of technology and knowledge;
- Development of infrastructure for innovation support" (Strategy of Scientific and Technological Development of RS, 2010-2015:21).

A strategic model of the development of this field assumes organized, systematic work on encouraging and promoting innovations in order to make creativity the basis of material and spiritual development of our country and a recommendation for equal participation and better ranking of the SME sector in international work distribution.

5. CONCLUSION

Analyses of the interrelation of socio-economic development and the intensity of innovative activities indicate that the achieved level of socio-economic development of the national economy is in a direct relationship with the dynamics of innovative development. Innovations have always been a weakness of enterprises in Serbia. If technical and technological progress continues to primarily rely on the transfer of foreign technology, there will be a great foreign exchange outflow for license purchase, and a consequence of such a state is limited opportunity for export and development.

For stable long-term economic development, it is essential to ensure that local innovative activities are encouraged. Stronger reliance on their own technical and technological achievements and higher investments in their own R&D activity would

improve business performance of export SMEs, especially those which develop new products or services in order to launch them in international market. Determined orientation towards the export of products and services of a higher level of processing, based on the forms of non-price competition, would successfully solve the problem of foreign trade deficit, considering that innovations are the most efficient way of building a better competitive position and that the practice of stimulating export does not represent a comprehensive solution, but only a short-term and partial one.

The success of a particular enterprise depends on their cooperation with other participants in the "innovation system", which involves participants from business sector, public sector and knowledge sector. All participants of innovation system should cooperate in order to create an innovative environment aimed at achieving innovations. This model of cooperation between the three sectors is called the Triple Helix model. It emphasizes that innovations depend on the interaction between universities (academic research), dynamic entrepreneurship ready for business risks (private sector) and public political sector (state administration and the government) which supports that. The interconnection is crucial for the success of the Triple Helix model, and the relationship between enterprises and scientific institutions is particularly important.

A prerequisite for focusing on their own development is introduction and implementation of a policy of scientific and technological development. Most SMEs would accept the support, especially if it were followed by well-organized advisory activity related to technology and market. Moreover, science should be viewed as a part of an entrepreneurial chain which is closed by successful business performance.

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