The gap between science, education and economy of Serbia and developed countries

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This study examines problems of national development in Serbia from the perspective of science, higher education, and economy. Identifying these problems is based on presentation and analysis of indicative examples and data, and previously defined factors of national development related to knowledge, finally pointing out to the evident gap between Serbia and the most competitive countries. The study is based on perception of strategy of scientific and technological development of Serbia (2010 to 2015), national strategy of economic development (2006 to 2012) and lack of strategy of higher education, and revolves perspective of science, technology and higher education in Serbia. It was shown that in Serbia, there is no compliance between higher education, science and economy. Small percentage of highly educated population (6.5%) and brain drain contribute to problem deepening. This paper suggests that there is no systemic and strategic planning of these decisive factors of development. The existing strategies are not compiled or sufficiently precise in essential issues, such as priority fields of economic development, harmonization of higher education (budget quotas) with the needs of economy and scientific and technological development, measures of brain drain prevention and encouragement of scientific cooperation with foreign countries.

Key words: National strategy, science, education, competitiveness, economy.

INTRODUCTION

"He who does not ask a question learns nothing (African Tribe Swahili)". The essence of investment in knowledge in one country, whether is it about education (especially high education, having in mind the level of education and specialization) and/or scientific and technological (in further text: S&T) development, is in training that country to create new values, the values in the form of products and services that it will be able to place in increasingly demanding world market. Standard of living also depends on the ability of economies to create, place and sell those new values. Trends of globalization and informatization, which, on one hand, eliminate the barriers in foreign trade exchanges and increase the standards that products and services should meet, are increasingly hampered and complicate the process of creating new values, so, for the sake of maintaining high standard of population, it is necessary to have more investments in knowledge and education. This ability of creation and placement of new values, which enables foreign trade deficit in increasingly severe market conditions, ultimately makes the competitiveness of one country’s economy, the capacity to maintain in the internal and international competition and to obtain economic advantages from this. National competitiveness is the ability of nations to introduce innovations in order to achieve and maintain leadership role in key industrial sectors (Porter, 1990). Competitiveness of economy is directly proportional to the competitiveness of economic

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Focus of the study

This study, from the perspective of science, higher education and economy, have the main aims to define the problems of national development in Serbia and to consider the gap that exists between Serbia as a country in development and the most competitive countries. The basic outline of this paper is two-fold:

1. Based on the practice of the most competitive countries by WEF, the competitiveness factors related to knowledge are determined (as bases of the development of each society and foundation of the three driving forces: science, education and economy).

2. The problems and perspectives of science, education and economy of Serbia are defined on the basis of previously determined factors, indicative examples, data and analysis of relevant strategic documents. Special attention is given to the observation of the strategy of scientific and technological development of Serbia (2010 to 2015), national strategy of economic development (2006 to 2012) and the lack of the strategy of higher education.

FACTORS OF THE COMPETITIVENESS OF ECONOMIES THAT REFER TO KNOWLEDGE

The factors mentioned represent those factors that are related to knowledge (policy of science and higher education), according to which the most competitive countries give the best results. These factors do not include all indicators of competitiveness on which the WEF methodology is based, because they are not related to knowledge, but they imply a broader context. Knowledge factors that contribute to competitiveness are of a broader context than innovativeness (although it is also included here), which is thoroughly examined in literature and practice so far. Detailed methodology of innovativeness research at international level is developed and it is regularly conducted by many organizations, among which the most familiar are: European innovation scoreboard, science, technology and innovation in Europe; main science and technology indicators and the global innovation index.

Innovations in products, processes and technologies and increase of the so-called know-how become inevitable not only for companies, but for entire economies as well. Primarily, Lisbon strategy, and then its successor “Europe 2020”, point out the need of investing in research and development (R&D) from 3% of GDP. “Modern societies expect from the science not only to improve the perception of nature, but also to develop technology”, which contributes to the higher standard of living (Ruttan, 2001: 538). According to the

1 WEF methodology includes 12 pillars of competitiveness: basic needs (institutions, health and basic education, infrastructure, macro-economic stability), factors of efficiency increase (market efficiency, high education and training, technological readiness, sophistication of financial market, market size, efficiency of the labour market) and factors of innovations and sophistication (business sophistication and innovations).
OECD findings for 2007, for total investment in science in percent from GDP, Sweden is at the top of the list with 4% of GDP, Finland 3.5%, then Japan, Korea, Switzerland and USA from 2.5 to 3.5% GDP. Serbia is at the bottom with investments less than 0.5% of GDP.

The extent of which newly-created knowledge and technologies are embedded in business and production practice for the sake of creating new values and comparative advantages, represents a knowledge transfer between the industry and university. This knowledge exchange is a driver of economic development and it is a relevant indicator of the competitiveness of economy.

Figure 1 presents the knowledge transfer between the industry and university according to OECD for 2008. As can be seen from this figure, countries that are singled out by this criterion are among the first ten from WEF competitiveness list, for several years in a row, with insignificant changes in order. Significance of cooperation for knowledge transfer is also indicated by the EUROSTAT data (2008), which show that 26% of innovative companies were included in some form of cooperation with other enterprises, universities, scientific institutes, suppliers, buyers or competition in EU-27. Comparative advantage of these countries is generated, except for investments in R&D, also by the fact that economy has a significant share in financing scientific and research work. Industrial sector becomes a growing driver of R&D, whose results will (usually by an order) bring them the competitive advantage. Knowledge transfer between science and industry largely represents the consequence of investments of business sector in R&D.

Innovations and diffusion are central activities included in technology (Narayanan, 2001). According to OECD data (2008b), the greatest investments of industry in R&D in percentage from GDP for 2006 have occurred in Sweden, Japan, South Korea, Finland, Switzerland, USA, Germany and Denmark.

In order to obtain a broader picture of the share of business sector in R&D in relation to other sources of financing, Figure 2 shows the relationship of the investments of business sector in R&D (BERD); higher education (HERD) and country as a whole (GovERD) for 2008 in countries of OECD (Scottish Government Statistician Group, 2010: 2).

Figure 2 shows the dominating driving role of the industry of R&D work in highly developed countries, which are leading by the WEF competitiveness report. Inherent for the agreements of R&D character between industrial and scientific sector is the formation of consortium, that is, strategic alliances. Frequent motive of the formation of industrial clusters is increase of financial potential for R&D. Very often, the consortiums of private companies are formed in order to support the projects of technological development that could not be financed by one company only (Narayanan, 2001). According to the latest WEF (2010: 480) report, Serbia is

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2 When considering these comparisons, level of country’s development is also relevant because GDP of highly developed country with small population can be higher than GDP of undeveloped country, even with greater population. Therefore, for example, 0.5% of Serbian GDP is by far less than 0.5% of the GDP of Sweden.
in the 122nd place for cluster development. Leading countries are, respectively: Italy, Japan, Taiwan, Switzerland, Singapore, USA, Hong-Kong, Sweden, Finland and Great Britain (Italy traditionally has high-developed clusters and particularly, cooperatives, and Hong-Kong and Taiwan have a growing path in all fields of competitiveness). Communities (clusters, cooperatives and strategic alliances), which the companies form for the sake of the transfer of knowledge, ideas and other resources, play a key role not only in strengthening financial capacity for R&D, but also, in the diffusion of technology and knowledge, and development of know-how in industrial branch. “Sharing knowledge is a process of the expressed social component” Arsenijević et al., 2009:531, According to Eurostat (2006), the greatest number of innovative companies working in cooperation occurs in Finland, Sweden and Denmark - developed countries highly ranked by the WEF competitiveness report. Concept of open innovations (Chesbrough, 2008) explains the necessity of knowledge transfer between interest groups. Chesbrough and other authors even suggest that sustainable competitive advantage of the company is no longer guaranteed exclusively by R&D, having in mind the mobility of labour and increasingly smaller possibilities of a company to retain intangible resources. Its advantage, supposedly, lies more in introducing the innovations on the basis of external sources of knowledge – ability to absorb the knowledge from the environment, primarily from associates (Lin et al., 2009; Laursen and Salter, 2006).

Studying the practice of highly developed and the most competitive countries also points out to the fact that both nature and structure of R&D work is relevant, so, it is directly influenced by the source of financing. Namely, in developed countries, we can observe the change in relations between basic and applied research and development. Figure 3 presents the expenses for research and development in USA, based on the source of financing and type of research (basic research, applied research and development) in millions of dollars (Congressional Budget Office, 2007: 11).

Figure 3 points to the trend of increasingly intensive participation of industry in financing of the research, by directing the greatest part of investment on the applied R&D. US Government, unlike the industrial sector, more evenly distributes the investments on basic and applied R&D\(^3\). As Jovanovic et al. (2010:640) have pointed out that, “in the mid seventies of the twentieth century, the US has made a strong shift towards the entrepreneurial economy” therefore; its economy has recognized efficient strategy for turning scientific knowledge to competitive advantage. Creation of new knowledge and investing it in the creation of new values (which are

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\(^3\) Basic studies are focused on discovering scientific knowledge without commercial pretension, while applied studies activate scientific knowledge for practical purposes. Development applies scientific knowledge in the creation of specific products meant for different markets.
described by previous data) represents the first aspect of country’s competitiveness, while the second aspect is investment in distribution and quality of education of the population. Economy, education and science and technology are three pillars of developed society, which need to be in conjunction. While economy is the one that provides funds for science and education by creating new values and placing them in global markets, and the science is the one that provides a necessary precondition for the competitiveness of economy by creating new knowledge and putting it into the function of economy’s development; education provides a critical mass of both scientists and wider population that will apply most contemporary knowledge for the development of economy and society and thus it will be the carrier of economic and technological development. Educational systems enable the new generations to raise general competitiveness of economy by their knowledge.

It is understandable that educational systems are successful in proportion to how much is invested in them. According to the data from 2005, world leaders by investing in education (at all levels in total) are USA with 7.34% GDP, Denmark 7.1%, Sweden 6.46 and Norway 6.37%, while Serbia invests 3.3% GDP. UNESCO recommends public expenditures for education to be about 6%, which is also the average for countries that belong to OECD. One of the indicative data of investing in higher education is per a student at the level of a country, observed for the period of one year.

The most annual investments per a student in formal education (at the level of educational institutions) in 2007 (OECD, 2010b) were in USA, then Switzerland, Norway, Austria, Denmark, Sweden, the Netherlands and the UK. While previous data can be questionable in the aspect of dependence from the efficiency of higher education, the following data dispels questionability by pointing out that, in reasonable tolerances, the countries that invest the most per student also have the greatest share of highly educated population. In the Europe, by the share of highly educated in the total number of population, the following countries stand out: Finland (36.4%), Norway (34.2%), Denmark and Ireland (32.2%), Germany (24.3%), then from the wider environment: Greece (22.7%), Slovenia (22%), Poland (18.7%), and closer: Croatia (15%) and Serbia (6.5%) (data are only valid for OECD in 2007; they do not include all the countries of the world).

### PROBLEMS OF HIGHER EDUCATION AND SCIENCE IN SERBIA AND REVIEW OF THE STRATEGIES

Although by many studies Serbia is not even classified (which is an indicative data by itself), selected studies in

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In this case, by efficiency we imply the ability of higher education to give the best results for the money invested.
which it is classified indicate the urgent points by which it and other countries in development must progress if they plan socio-economic progress.

Education of the nation and quality of higher education

Comparative data about the share of highly educated population are devastating for Serbia, knowing that it is considered that one medium-developed country should have at least 20%, and that the trend is a progressive increase of this share. High education, however, loses the significance if its quality is not provided. One of the striking indicators of quality of higher education is non-placement of the University of Belgrade as the oldest and the biggest in Serbia on Academic Ranking of World Universities6.

The University of Belgrade was not mentioned on the list even in 2010, primarily because of unrecognizability and non-transparency (bad internet portal, poor information system, insufficient availability of data and lack of identity) and small scientific productions (small number of published papers per a professor in world scientific magazines). This data suggests the level of quality of higher education in the rest of the country, as well as the significance of such a low level of 6.5% of highly educated population.

One of the influential factors on the distribution of higher education and science is the presence and the level of scientific and educational culture of population. Therefore, Serbia and neighbouring countries of South-East Balkan need to focus on popularization of high education and science: implying systematic effect on attracting population through publishing activities, development and promotion of museums and other institutions, organization of exhibitions and festivals, support of the media in organization of campaigns, etc. In Serbia, positive developments are observed through annual organization of the science festival, starting from 2007 and building the Centre for Science Promotion, whose construction is planned for 2012. In Czech Republic, for example (as a recent member of EU and former socialist republic of Eastern block of Europe), there are two centres for the science promotion, one university that has its own programme of science and education promotion, and two science festivals, organized annually: night of science and week of science and technology (downloaded from the website on May the 01st, 2011: http://www.czech.cz/en/101997-popularisation-of-science-in-our-country).

Harmonization of higher education and economic development

Earlier, on the basis of data presented, it is shown that higher education realizes its functionality primarily by harmonizing with present and future needs of the economy and that essential strategic planning is outlined in this collision. Lack of the same in Serbia is obvious already through the fact that there is a Strategy of Economic Development (2006 to 2012) and Strategy of S&T development (2010 to 2015) but not the strategy of higher education. Mere adoption of strategic documents will not provide implementation of comprehensive development of society; this fact however indicates on the lack of systemic and strategic planning of society development in Serbia.

Structure of graduate students from the University of Belgrade, for example, for 2006/2007 is such that the largest is socio-humanist branch (45.5%), then, technical and technological (31.5%), medical (16.7%) and science and mathematics only 6% (MSTD, 2009). The situation is similar at other universities. It is common that a small number of students graduate in natural and technical sciences, and greater number in social sciences, which is directly in contrast with the priorities of the Strategy of Scientific and Technical Development, which are primarily oriented on technical and natural sciences6. When it comes to the strategy of economic development, within it, there are no either explicit or elaborate specific fields on which Serbia should focus in the form of absolute priorities made on the basis of domestic potentials, demand in the global market and technological changes in global context7. This strategy, by focusing primarily on macro-economic and administrative measures of strengthening economy, has remained imprecise in its essential part – defining priority fields in which Serbia needs to develop and based on which both science and education, through the definition of strategies and their implementation, should be established. In the strategy of S&T development of Serbia, it is spoken about reconciliation of previously opposed occurrences (higher education and development of science and technology) through direct measures of the harmonization of the number of enrolled budget students by the fields with determined strategic priorities and indirect measures of encouraging the studying of natural and technical and technologic sciences. However, nothing more specific precisely

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6 The Strategy identifies following priorities: biomedicine, new materials and nanosciences, environmental protection and climate changes, energy and energy efficiency, agriculture and food, information and communication technologies and improvement of state decision making and affirmation of national priority.

7 It is implicitly mentioned, but it is not elaborated, that the formation of new industrial structure should be realized “through the development of high technologies in the fields: part of chemical industry, pharmacy, information and communication technology, part of electronic industry, food industry, etc.” (National Strategy of Economic Development of Serbia 2006-2012, pp. 45).

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5 Criteria for ranking on Academic Ranking of World Universities (also known as Shangai list): number of alumni and staff winning Nobel Prize or the most respectable world acknowledgements; number of publications in international publications from SCI list or prestigious journals (Nature i Science); number of quoted papers; number of foreign students and quality of Internet presentation and availability of data.
explains what is implied by those measures and what the plan of activities is. In addition to the participation of highly educated population, the quality of knowledge provided by higher education is extremely important, as well as the structure of highly educated population by fields of expertise and its harmonization with the needs of economy, because only in that way is it possible to ensure the strengthening of economy on the basis of higher education. From generally small number of highly educated population in Serbia, even smaller number is functional, that is, performs the jobs for which it is qualified.

In Serbia, for example, there are too much faculties of law, economy, mechanical engineering, and thus these educated people find it difficult to get a job and perform jobs for which it is sufficient to have a high school degree. On the other hand, human resources specialized for ICT (information and communication technologies) are lacking. While highly developed countries correct their errors of bad higher education planning by importing experts, developing and transition countries suffer a double loss: in the form of the departure of educated human resources and money that was spent for their education. Through the following digression of the relationship between education for management and needs of economy, we will precisely illustrate the harmonization of education and economy in Serbia. Serbian economy recognizes the need for managerial staff in many fields, although those needs are too general and insufficiently articulated: thus, general managers are needed in agriculture, health, construction, media, informatics, pharmacy and other fields. Some of the required and popular managerial jobs in Serbia are marketing manager and human resource manager, while in the economy, there are needs for more sophisticated jobs, such as brand manager, production and logistics manager, research and development manager, financial manager etc, that remain unnoticed.

Furthermore, education has responded to this need (creating a very lucrative market of education for management), but it is inadequate – because in Serbia, there are about 50 faculties that offer the education for managers today (by far more than a country such as Serbia needs), and that is still in the sense of providing the general, rather than specialised knowledge. Moreover, the state is not able to recognize what the economy needs, so, even with the expressed need for managerial staff in Serbian enterprises and 15 years of existence of the management faculties, the management profession is listed in the nomenclature of professions of the National Employment Service of Serbia only in 2010! It is obvious here that neither economy understands and looks for what it needs, nor the education responds to those needs in the right way, nor the state adequately regulates and intervenes in this situation. The data about significance of quality management in order to raise the competitiveness is also obvious from the prognosis that managers from the USA, as one of the most competitive country of the world, will make up a third of the total labour until 2014 (downloaded from the publication of The US Bureau of Labour Statistics from the website: http://www.bls.gov/emp/optd/). Three greatest problems that Serbia is facing with are precisely: low competitiveness, poor export and unemployment, and direct consequence of bad management. From this point of view, the need of effective recruiting and selection of managers is also obvious: “common practice by hard criteria certainly does not bring results today, it is necessary to identify the necessary missing intangible capital, that is, by the process of managers’ selection, it is possible to discover the degree of their communicativity, spiritual and emotional intelligence, readiness for changing oneself and your subordinates, charisma, ability to create social networks, and finding knowledge” (Tot, 2011: 470).

One of the basic measures that countries that experience lack of “cooperation” between education and economy should take is to form the strategy of higher education. With this document, it is necessary to perform a comprehensive strategic planning of higher education on the foundations of the guidelines for entire society and enable the solving of all mentioned issues about the presence of highly educated population, quality of education, harmonization with economy and S&T development. The fact that Serbia still does not have a draft of the strategy supports the problems that are mentioned here. Budgetary entry quotas, determined by the Ministry of Education and Sports of Serbia and at the proposal of the faculty, remain unchanged from year to year, with insignificant changes.

In the aspect of linking higher education, science and industry, it is interesting to mention as a positive example from the environment, Skoda Car High School, faculty established in 2000, the first and only one established by a company in Czech Republic, which educates its human resources and prepares them to work in company’s R&D sector (downloaded from website on April the 28th, 2011: http://new.skoda-auto.com/company/cze/savs/about/practical/Pages/practical.aspx).

Cooperation between science and economy

In the strategy of scientific and technological development of Serbia, the cooperation between science and economy was planned more carefully than the cooperation between higher education and science and technology. This cooperation is predicted through partnerships with economy (through framework for intellectual property and encouragements and fund for innovation activity) and partnership with other ministries. Partnerships with economy through a new legal
framework for intellectual property and encouragements is planned in the sense of encouraging the investments of economy in S&T development through tax cuts and stimulations for the employment of scientific and research staff, education of workers and resolution of the intellectual property protection issue. Fund for innovation activity is predicted as other instrument of public-private partnership for encouraging industrial investments in innovations of products, processes and services that will bring competitive advantage. Finally, the partnership with other ministries is also planned through the participation of scientific community in the cycle of infrastructure projects of the Republic of Serbia, by which it is predicted that the science is put in the function of infrastructure development of Serbia.

The ratio of basic and applied research

Although basic researches are important because they provide the foundations for upgrading the applied research and because they increase the flexibility and absorption quality of the society, trends point to the increasingly less investments in them when it comes to industry. Having in mind competitive nature of the industries of developed countries, trend is that commercial studies favours the projects that take less than 10 years to develop new product or process. Universities and research centres, which are mostly oriented on entrepreneurial behaviour, are increasingly adapting their work to the requirements of business structure as a significant source of financing, while the lack of investments in basic research (often insufficient) is compensated by financing from the part of the states and higher education. A striking fact is about the relationship between basic and applied studies in the USA, which clearly confirms this trend.9

Investments in R&D require great sacrifices, especially when it comes to basic studies that are more expensive, last longer and they provide less applicable knowledge. Education for top human resources is even more expensive, and it is followed by the risk of brain drain, which is particularly high in undeveloped countries. This imposes the issue whether Serbia, as an undeveloped country, with poor economy and small GDP, needs 28 accredited and state funded scientific institutes with primary activities of basic research. Today even bigger and more developed countries often import the necessary scientific staff or, even more drastic: dislocate scientific and research work (in developing countries: China, India, Russia, Brazil, etc) (OECD, 2008a). An interesting data is that in 2007 there were 3,264 completed papers from the field of basic sciences, and 1,539 papers from the field of applied sciences (downloaded from the website of the Statistical Office of the Republic of Serbia on March the 16th, 2011: http://webzrzs.stat.gov.rs/axd/dastra/stra.php?slf=0011 &izbor=odel&tab=9). Moreover, in this context, it has to be considered that while developed countries realize efforts in technological improvement based on scientific or applied research, developing countries are basing rather on imitation and improvement of imported technology. Problems of ineffective scientific research in Serbia are evident from the fact that there is significant overflowing of human resources from scientific-research institution into higher education institutions (where the salaries are higher today in Serbia) in the country and abroad, resulting in the fact that research institutes do not have competent staff. Commercial applied research, which the scientific-research organizations are turning, are still mainly oriented to European funds, such as IPA, SIP, COST, or CIP10 projects, which prevents the developed knowledge to remain in the country and bring a competitive advantage. On the other hand, the commercialization of scientific research in terms of knowledge transfer between science and industry in Serbia is almost nonexistent.

When we take all this into account, it is clear that developing countries need a strict focus on the applied studies in clearly defined fields that are determined on the basis of priorities of economic development. The same fields also need to be the priority fields of higher education (there are slim chances that undeveloped countries will import experts, for them it is by far more important to keep their own by various incentive programmes). Therefore, we must take into account that, generally, the fields of high significance for research, both for developed and undeveloped countries, are sustainable development, including primarily alternative energy sources, energy efficiency, organic agriculture, water purification etc. Strategy of S&T development of Serbia provides incentives precisely for scientists in domain of basic studies. Positive side of the strategy is in recognizing the significance of interdisciplinarity, so multidisciplinary and interdisciplinary studies are set as priorities in a new project cycle. Many prominent macro-economic analysts, including Natarayanan (2001), distinguish interdisciplinarity, that is, technological integration as a dominant trend that sets new standards in conducting scientific and research work.

Brain drain

In the last 20 years, about 100,000 people with high and

9 There will be no discussions about the negative aspects of commercialization of S&R work in this study, having in mind that it is complex topic that requires detailed thinking and inclusion of other, related topics, such as market orientation and privatization of high education and democratization of scientific an technological decision-making. This suggestion of increasing applied research is strictly formulated from the aspect of increase of economies’ competitiveness, which is the central focus of this paper.

higher education has left Serbia, and the trend of so-called brain drain is still present. Education of one highly educated expert is an investment of approximately 300 thousand dollars. From 1990, Serbia has lost 12 billion of dollars by brain drain. According to the list of WEF, only three countries among 134 are in a worse situation than Serbia according to the indicator of the brain drain of educated human resources.

Recent demand for 2500 doctors from South-Eastern Europe, specifically from Serbia, is an obvious example of this phenomenon. There were 2000 unemployed doctors in Serbia in 2010. Education of one doctor requires investments greater than € 50,000, and while Serbia and neighbouring countries suffer enormous losses on the brain drain because of poor organization and discrepancy between higher education and economy, more developed countries benefit on it (by importing ready-made experts, without financing their education). It means that poor countries finance social development of developed countries.

This trend is not only influenced by poor economic state within the country, but the external factors as well, among which growing demand from abroad for professional staff is dominant. Increase of investments in R&D work and its internationalization cause the increase of the need for scientific and research staff and literally increase competition in attracting and employing good experts and researchers. In Germany, the employment of 400 thousand engineers and scientists is planned in the following 8 years, primarily from immigration. China performs extremely high investments to return its scientists from America. As a counterpart to the green card, there is European blue card, so that Europe could take over the greater part of global scientific talent. In addition to this factor, internationalization of scientific and research work is increasingly spreading. As a result of globalization, centres of science and technology are multiplied, both by encouraging domestic investments and by out-sourcing. In addition to West Europe, USA, Japan and Canada, other countries as well are becoming increasingly present and popular in this domain, such as Russia, China and India\(^\text{11}\), as well as Middle East (OECD, 2008a). Opportunities for departure of educated human resources from Serbia and neighbouring countries, in that way, are increasing and they become a big threat to brain drain. Not even the best strategies and the most successfully implemented plans of strengthening social, economic and S&T development will bring the results if this problem persists.

Although Serbia and other undeveloped countries from the environment are not in economic position to perform significant return of their scientists from abroad, it is very important for these staff, which is intentionally educated for priority economic and R&D fields, to be kept in the country. The consequence of brain drain of the young educated experts, that is, inability of Serbia to keep them through enabling appropriate conditions for scientific work (lack equipment of scientific institutes, malfunction and obsolescence of equipment, lack of scientific literature and access to databases and unattractiveness of scientific programmes and institutions) implies the age of the existing scientific and research staff, based on which future of science in Serbia is unsustainable. In the strategy of S&T development of Serbia, “development and preservation of talent” is mentioned as the first step, with the work on the animation of scientific and research staff for staying in the country through the (continuation of) scholarships, apartment construction and support to training abroad. More detailed measures of these instruments are not shown. The following manner of strengthening scientific and research work is in using the trend of its internationalization. Dislocation of scientific and research work from developed countries to already mentioned destinations can partially be redirected on Serbia as well, with investments in ICT, regulation of intellectual property rights, tax incentives and databases of Scientific and research staff and centres. Finally, S&T development can also be strengthened through strengthening the relationships with the diaspora, both for project financing, signing the contract with industry abroad, as well as for international scientific cooperation with leading research staff of Serbian origin.

CONCLUSION

The best time to plant a tree was 20 years ago. The second best time is now.

*Chinese Proverb*

It is well-known that the focus of the problems of undeveloped countries is their lack of competitiveness. The first aspect of country’s competitiveness represents the creation of new knowledge and investing it in the creation of new values, and the other is investment in distribution and quality of education. Economy, education and science and technology are three pillars of developed society that need to be coupled. While the economy is the one that provides funds for science and education by creating new values and placing them on global market, the science is the one that provides a necessary precondition for the competitiveness of economy; the education provides a critical mass of population that will be the carrier of economic and technological development.

The successor of Lisbon Strategy: “Europe 2020”, includes the goal to invest 3% of GDP in research and development at the level of Europe. This strategy also appeared to be successful and in the previous round (until 2010). The following goal that is established by this strategy is to reduce under 10% the share of children that

\(^{11}\) It is estimated that a few hundred millions of dollars per a year overflows from USA to China and India through individual scientific cooperation (http://www.astromajka.co.rs/nauka/2638-perspektive-istraivalakog-rada-u-serbiji.html).
leave elementary school, and to increase over 40% the share of the young with university degree (European Commission, 2010)! These brave goals are set on firm foundations. In the first chapter, it was already shown that investments in education and science and technology and putting the same into the service of economic development inevitably bring competitiveness, and thus social welfare. In that sense, it becomes clear which path should undeveloped countries follow.

In Serbia, decadence of observing science and education is expressed (both in economic sector and broader public, as well as in educational and scientific sector) to the extent that they are often treated as activities that are goals to themselves, and not the activities that are in service of the development of economy and society. Science in Serbia is almost exclusively initiated and financed by the state (in small percentage) through the projects of the Ministry for Science and Technology. In order for science to give its contribution to the development and competitiveness of industry, it is necessary to establish national innovation system in a form of complex network of institutions, including primarily private sector and industry, which accomplish generation, diffusion and application of S&T knowledge.

As Vajargah (2010: 804) pointed out, “with growing pressure on the public sector budget, funding organizations have instituted formal Research Needs Assessment to insure that research resources are allocated in a way that is consistent with the national objectives or specific needs”. Inefficiency, laziness and inadequacy of education in Serbia are visible on the basis of different criteria: direct, such as PISA and TIMS competitions or Academic Ranking of World Universities and indirect, growing needs for additional training and retraining of persons with secondary school diploma and university degree, disproportion of educated staff and the needs of economy (great number of unemployed highly educated individuals as opposed to unsatisfied need for educated staff of other professions). State (through National Employment Service) and employers invest enormous amounts of money in additional training of inadequately educated human resources.

Earlier, it was shown that in Serbia, there is no compliance or cooperation between higher education and economy, science and economy, even higher education and S&T development. Small percentage of highly educated population (6.5%) and brain drain contribute to problem deepening. Everything suggests that in Serbia, there is no careful systemic and strategic planning of these decisive factors of development. While there are the Strategy of Economic Development (2006 to 2012) and the strategy of scientific and technological development (2010 to 2015), strategy of higher education has still not been adopted, not even in the form of a draft. Besides, the existing strategies are not complied or sufficiently precise in essential issues, such as priority fields of economic development, harmonization of higher education (budget quotas) with the needs of economy and S&T development, measures of brain drain prevention and encouragement of scientific cooperation with foreign countries. Although in the strategy of S&T development, some of the key factors are recognized: partnership of economy and science and technology, whose results are yet to be seen, the analysis of the results of technological development projects realized in the previous period is still lacking. What is the right way to plan new cycles and go on if there is no feedback?

In Harvard Business Review from 1996, Gary Hamel has defined the strategy as a prediction of how the market will look like and training the organization to gain advantage in such a market. Regardless of the social structure in question (organization, cluster, region, state, etc.), the strategy of development needs to rely on predicting market condition in today’s condition of rapid changes.

Today, it is anticipated, as it is suggested by OECD, on the basis on scientifically-based technological predictions (foresights) “Based on such foresights, Great Britain has adopted the strategy of development of communication technology and electronic industry in the period 1994 to 1998. In that way, the fields of priority significance for financing R&D activities strategies have included the development and market segmentation, reorientation in education, studies from the field of ICT management, good practice transfer in process technologies and in industry of defence, changes in financial and tax sector, etc” (Arsenijević and Arsenijević, 2008: 258).

In Serbia, however, it cannot be seen from any document that strategic planning is designed in relation to technological predictions. Strategy of S&T development to a certain extent mentions the trends of S&T development in the introduction (they reflect the tendencies of current events), but none of them is based on the analysis of technological foresights (they anticipate the tendencies in the future). Among the nine criteria for the formation of priorities of the strategy, not a single one refers to them. Focus of scientific and research work at the national level must be constituted not only on the basis of factors that reflect the existing state and experiences from the past, but also the conditions that will be present in near future.

12 OECD (2006) in the document Good Practices in the National Sustainable Development Strategies of OECD Countries even suggests the linking of strategic documents into a logical whole and cooperation of competent institutions. In harmonizing domains that the strategy includes, some countries have, when designing National strategies, made another step forward: expanded social issues from domestic to international field. Norway, for example, among the goals of social sustainability also includes the growing development of programmes of helping developing countries (OECD, 2006).

13 Scientifically based predictions and evaluations primarily come from the field of ecology. Environmental impact assessments is a method that measures possible environmental effects of various policies a lot before than they are made, and they are used by Denmark, Norway, Netherlands, Sweden, and Great Britain (OECD, 2006).
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