



THE ROLE OF STATE IN THE DEVELOPMENT OF SCIENCE AND EDUCATION

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Abstract

Knowledge economy, new economy or information economy, seen not only as a scientific category but also as a specific social event as well, has recently become the part of the scientific and professional communication and social reality. Future of the mankind and solving of the acute economic, social and ecological problems are definitely connected with the development of the so-called knowledge economy. Just like other social processes, development of the knowledge economy is above all conscious and targeted behavior of people, social groups, and societies. That is why this study will answer the question, whether or not the government of the Slovak Republic realizes the need for the development of the knowledge economy, and what place this need has among its other priorities.

KEY WORDS: Knowledge economy, Science, Research, Education, Infrastructure, Government policy.

Introduction

Main directions of technological and therefore also economic progress on the turn of 19th and 20th century were development of information technologies, electronics, bio- and nanotechnologies, etc. Revolutionary character of innovations within economic and social progress would not have been expressed without previous adequate changes in science and in its influence on this progress. In the post-war period, the need for new electronic devices and technological processes created out of science, previously seen as random activity, the branch of economic production with specific and different product – scientific inventions and discoveries. Same development can also be observed in the late 20th century, when the permanent need for new knowledge arises, which could be used in specific branches of economic production and other spheres of social life.

Economic and social progress and solving of urgent global, environmental, social and political problems of present world are connected with the development of knowledge economy and transfer of its products (innovations) into other spheres and branches of economic production. Development of the knowledge economy requires adequate (creative) system of vocational education and training, needed for the creation of innovations by operatives. Another requirement of this development are the activities of relevant social subjects, that have immanent interest in its development and utilization of its products. These subjects are mostly manufacturing enterprises (private capital) and state as a representative of public capital. Only after the above listed subjects become aware of this interest in the knowledge economy development and only under the

terms of coordination of theirs activities, such as development of science and education, the development of knowledge economy can become progressive and effective. This study attends predominantly only one of these subjects – the state – and its policy of the development of science and education as the basic elements of knowledge economy. Therefore the goal of this study is to define the role of science and education within the knowledge economy and to determine their position and significance among the priorities of state policy of science development and education in Slovakia.

Research methods used in given study:

- analogy method while analysing the nature of knowledge economy and classic economic production;
- analogy method in characteristics of science, research and education as production components of knowledge economy;
- statistical methods while analysing the indicators of academic education development;
- correlation analysis of trends in number of students, lecturers and state expenses on education.
- Scientific originality of the article is:
- justification and characteristics of science and research as a technological (production) part of knowledge economy;
- description and justification of vocational education as infrastructure for the creation of innovations in the conditions of knowledge economy;
- determining of long-term trends in number of students, lecturers, their correlation with the trends in college financing and defining of their

- importance for the education development in the conditions of knowledge economy;
- defining of current position and importance of science and education among the priorities of government education policy.
- Practical significance of the article is:
- analysis and justification of human capital and innovations as main factors in the process of creation of innovations have its importance in the understanding of fundamental nature of knowledge economy and its role on the solving of present global economic, social, energetic and environmental problems;
- scientific results of the given study have a significance for determining the priorities when creating economic and social policy of the state;
- results of research are the basis for planning and realization of effective precautions taken by the state policy of supporting the development of science, research and education.

Material and Methods

Science, research and education as production factors of knowledge economy

The need for innovations was caused by the series of economic, technical and social factors. Processes of the world economy formation, competition growth and technological progress resulted in the shortening of product life cycle on the market. This soundness observed on the turn of second and third millennium was also valid during the period between the scientific discovery (or technical invention) and its application in praxis. While in the 19th century the average time between scientific discovery and its realization in the production or technological device was approximately 50 years, in the late 20th century it was only 10 – 15 years. For the manufacturers it meant that the applied knowledge was becoming the factor of competitiveness. Therefore the companies, which wanted to remain competitive, were trying to bring the new products on the market as soon as possible. And that is the reason why the information is required, how to achieve the product to be new, different from previous, less materially and energetically demanding, more functional, etc. Technological niveau of the manufacturing processes during late 20th century is no longer a limitation for the innovations of products. The only limitation stays the absence of new knowledge.

Term “new economy” is often used for naming those qualitative and quantitative changes, which resolutely altered the structure of economic growth factors and the rules, by which the previous economic model operated [Bell, 1999; Kelly, 1998]. However, most authors use this term in order to name the fact that the knowledge and information are becoming the decisive capital, cost factor and the source of economic development [Drucker, 1995. (1995; Ketkar and Sett, 2010; Kumar, 1978)].

New economy is the economy of knowledge and ideas, where the innovative thoughts and technologies applied in services and goods are the key to creating new working places and higher living standard. “It is the economy, where risk, uncertainty and constant change are more a rule than an exception” [Balaž and Verček, 2002].

Above all, this term means that it is something new, what distinguishes itself from the old one. It is new not only because knowledge is its driving engine (knowledge economy), neither because it uses innovations (innovative economy), nor because it is network-interconnected (network economy). Bell [1973] or Galbreith [1967] refer to the post-industrial society, which comes after the change of industrial one. Toffler and Tofflerová [1966] refer to three significant changes or to use his term – waves. First wave is associated with agrarian revolution, second with industrial and the third with informative. The main source of new knowledge is the intellectual ability of people to conduct a scientific research and produce new findings. In the knowledge economy the place of technological (manufacturing) process within the industrial production, which includes machines, energy, human labor, is taken by the process of researching and the creation of new information. This “technological” process involves mainly already acquired information and “old” knowledge and human intellectual labor – human ability to conduct research and therefore come up with new findings [Graeme, 2010, p.37-39]. That means that within the knowledge economy science and research are its technological element and simultaneously main production factor. And their development and significance for economy is to a considerable extent determined by the role of education in society and government priorities and by its quantitative and qualitative characteristics.

Another inevitable condition of the knowledge economy development – what essentially means the creation of innovations – is permanent presence of workers who have been educated and trained for scientific and research activities [Friedman, 1977]. These workers should be provided by the colleges and universities, which should have clear and distinct concepts about such aims and tasks. Part of these educational institutions should be apart from actual educational programs, which are adequate to the level and structure of economic activities, also the creative forms and approaches in education aiming to develop the creative activities of students [Savanevičienė, 2008; Karbach, 2012; OLTRA, 2012]. This task could be accomplished by differentiated system of academic education, as it was during the previous period, which would include colleges, which would train highly qualified researchers for operating within the individual branches of economic activities, and universities, whose objective would be the training of scientific researchers and teachers for higher education.

Analogically with the standard industrial production, the system of education is one of the most important infrastructural parts of knowledge economy. Just like it is not possible to effectively perform modern industrial production without modern elements of industrial infrastructure, such as road transport, information technologies, network of financial, marketing, business, personnel, consulting and other agencies, it is also impossible to develop knowledge economy without the system of education capable of training the workers needed in science and research.

Relevant indicators science and education development (scientific discoveries, technological inventions,

patents, financial expenses on science and education, number of students population class, academically educated people ratio in the employable population structure and so on) depend on technological forwardness of economy, labor productivity, position of science and education in society and government education policy priorities. In comparison with the expenses on science and education in developed Western European countries, which reach approximately 3 % GDP, reach these expenses in Central and Eastern Europe considerably lower figure – only about 1 % GDP (OECD, 2008). But the actual development of knowledge economy and direction of science and education development in individual countries cannot be determined on the basis of these indicators – with the exception that countries with figures reaching only 1 % GDP count as technologically less developed. Trends in the above mentioned indicators would be much more precise, since they would determine realistic direction of science and education development, and whether or not they are adequate to the requirements of knowledge economy.

Therefore this study focuses predominantly on the trends in the development of such indicators as state expenses on science and education development, number of college students in ratio to the generation class, number of students to one lecturer (one of the most important indicators of the quality of education) and the ratio of academically educated people to the employable Slovak population.

Results and Discussion

One of the main problems within the science development is the financing of basic research. After the political system was changed, Slovak academy of science – the base of scientific research – was radically reduced financially and administratively. But these funds were not automatically directed to the colleges and universities, what resulted in significant reduction of basic research. The task to conduct scientific research was assigned to colleges and universities but without proper financial and administrative support. It is known that the Slovak expenses on science are at the level 0.45 % GDP, while the European average is 1.76 % GDP. Only Bulgaria and Rumania have lower expenses, while on the other hand the expenses of such countries as Sweden and Finland reach the level of approximately 4 % [OECD, 2008]. From this point of view it is rather remarkable, how swiftly the rate of financing the science grows in countries like Russia, China, India, Brazil, Singapore or Israel [Hoscheková, 2008], governments of whose obviously became aware of the importance of innovations for social and economic progress.

Second problem connected with the science development is the transfer of knowledge and information into production. According to existing studies, present Slovak economic development does not create advantageous conditions for the establishment of effective transfer of scientific innovations into economic production [Šikula, 2008; Grenčíková, Španková, 2012]. Companies with the foreign capital are, when it comes to the innovations and development, usually connected with scientific and research organizations in their native

countries. Slovak companies mostly dispose of antiquated technologies, what results in low profits and an economic room for the investments into innovations. Simultaneously it can be pointed out that the scientific research in Slovakia almost does not even reach the level, on which it used to be during the previous political system. That means that the transferring process of scientific innovations into production is absent in Slovakia, and consequently the private investments into science are absent, too.

Establishing and development of new economy has yet to become the subject of broader discussion and the part of state proclamation and already elaborated long-term conceptions of social and economic development [Šikula, 2008]. The problem of forming the knowledge society and the new economy interconnected with science and education is apart from few exceptions almost completely absent in the expert, scientific and social communication.

Two trends were dominant in the academic education development in Slovakia since 1990s. First was the stagnation of funding by state, which used to be the main financial supporter of higher education. Financial expenses from state budget on colleges and universities operation reached in average 0.8 % GDP until 2006. In 2007 and 2008 expenses on education rose only mildly – approximate annual growth was 3 %. Instead of planned growth by 10 % in 2009 the expenses showed fall [Ministry of Statistics, 2010]. In 2010 the amount of money spent on education dropped to 4 % in comparison with previous year, and in 2011 by 5.5 % when compared with previous year, what in absolute numbers means that the amount of money invested into all parts of high education dropped by 23 432 862 euro. In comparison with 2009 it is fall by 9.5 % (Fig. 1). This means that fixed percentage amount of expenses on education to the GDP stays almost unchanged and that the extent of spent financial resources depends on the economy efficiency.

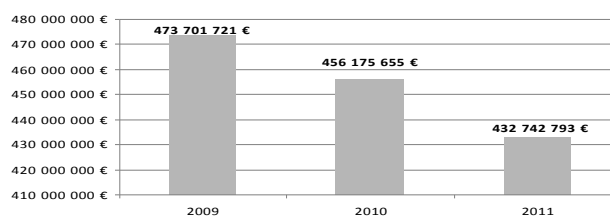


Fig. 1: College financing from the state budget (Ministry of Education, Science, Research and Sport of the Slovak Republic, 2011)

More detailed analysis shows that the biggest drop was experienced within the record “providing of high education and securing of college operation” – colleges and universities got in 2011 by 37 % less money than in 2010. On the other hand the record “academic science and research”, which to a significant extent determines the quality of education, showed that colleges and universities got by 63 % more, what in absolute numbers means 67 032 211 EUR. Other records stayed relatively stable and did not show more pronounced volatility [Ministry of Education, Science, Research and Sport of the Slovak Republic, 2011].

The second trend in the high education development was the enormous growth of number of students, accompanied by only negligible growth of number of pedagogues [Mederly, 2010, p.3]. For example, nowadays only slightly bigger number of lecturers “educates” almost twice the number of students they did 10 years ago (Fig. 2). The number of students falling on one pedagogue at Slovak colleges stays in average just under 30. At some colleges we can observe that the number of students falling to one lecturer reaches 40, even though the Accreditation Commission decided 25 students on one lecturer to be an upper limit. Only individual faculties of some Slovak colleges and universities reach the average of developed European countries – roughly 8 students to one lecturer [Pišut, 2010, p. 9].

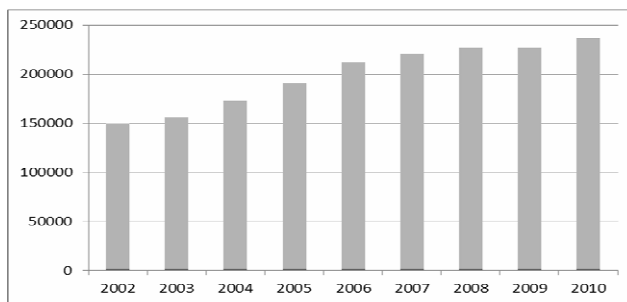


Fig. 2: Development of number of college students in Slovakia

Since the September 2010 are Slovak colleges attended by roughly 230 000 students, what is by 5 000 more than in 2009. The number of college students tripled since 1989 [Ministry of Statistics, 2010]. Colleges are trying to accept more students, because of the criteria which determine how financial resources from state budget are distributed. This is happening at the expense of accepting criteria difficulty. Moreover, universities lack sufficient number of lecturers – therefore those, who they do employ, have to attend continually increasing number of students. This has naturally negative influence on the quality of pedagogic process, lecturers lack time for lectures and seminars, not mentioning science or the time needed to consult closing theses.

National program of upbringing and education in Slovak republic, adopted more than 10 years ago, stayed on the level of declarations and was not implemented into legislative, institutional or financial measures. According to this program, it was expected that the number of students accepted to college would rise from 25 % of population class in 2000 to 30 % in 2005 and then to 35 % in 2015. Similarly it was assumed that the ratio of academically educated people in the structure of economically active population would rise from 8 % to 12 % in 2010 and to 16 – 20 % in 2020 [Mederly, 2010, p.3]. But the reality was different. Already in 2009 and in all subsequent years it was observed that the number of students accepted to college exceeded all expectations and represented 51 % of population class. Equally, the ratio of academically educated people in the structure of economically active population reached the level expected for 2020 – 17 % – already in 2009 [Mederly, 2010, p.3]. These remarkable trends in quantitative indicators of academic education development could be

evaluated as positive if they were accompanied by adequate financial and personal conditions. But actually, these trends (growth of number of college students while lacking sufficient number of lecturers) led only to the drop on the quality of academic education in Slovakia.

Conclusion

Both establishing of the knowledge society and development of new economy have become dominant in the direction of social and economic development in the developed countries. As a result of that, support of education, science and research is becoming the priority in the economic and social policy of state. As this and other quoted analyses state, the issue of forming of knowledge economy and therefore also the awareness of the importance of science, research and education in this process is not adequate on the social or on the state level. Science and education development in Slovakia happens under the influence of short-term tasks and current economic, social and political situations. Neither in the long-term programs or visions, nor in the short-term proclamations is the importance of establishment of knowledge economy adequately emphasized by Slovak government. The natural consequence of this fact is that neither education nor science and research are preferred government tasks, when it comes to the economic and social progress. Education and science do not have a proper place among the values of individuals or public, which would be adequate to the requirements of knowledge economy. Status and development of academic education, science and research, their organization, rules and funding are not adjusted to the requirements of knowledge society and new economy. Individual activities of colleges and scientific institutions, which can be seen as beneficial for the process of establishing knowledge society and new economy, are being executed rather in spite of state regulation and measures in the sphere of education, science and research.

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Summary

The technological and consequent economic development at the end of the 20th and beginning of the 21st century were based mainly on the development of information technologies, electronics, bio- and nanotechnologies and so on. But the revolutionary character of innovations when it comes to economic and social progress would be unable to manifest itself without previous adequate changes on the field of science and its influence on the technological and social progress. During

the post-war period there was a need for new technological devices and processes what resulted in the science being transformed into the branch of economic production with a specific and rather unique product – scientific discoveries. Similarly, in the end of the 20th century there arises a permanent demand for new discoveries that could be implemented in the specific branches of economic production and also in the certain spheres of social life.

Economic and social progress along with the solution of pressing global environmental, social and political problems are often associated with the development of knowledge economy and with the transfer of its product – innovations – into other spheres of economic production. However, the development of the knowledge economy requires the adequate (creative) system of education and training of employees that are absolutely essential for the creation of innovations. Moreover, it also demands corresponding activities from the relevant social subjects that have an imminent interest in the development of knowledge economy and the use of its products. These subjects include commercial businesses (mostly with private capital) and state as a representative of public capital. These subjects have to be aware of their interest in the development of knowledge economy, and they have to coordinate their efforts and activities when it comes to the development of science and education; only then can the development of knowledge economy be truly progressive and effective. This study focuses mainly on the latter of the above mentioned subjects – state – and its science, research and education policy, i.e. the basic components of knowledge economy.

The dominant trend in the modern social and economic development in the developed countries is gradual establishment and transition to the knowledge economy. Therefore, the economic and social policies of these countries should prioritise the development of science, research and education. The development of science and education in Slovakia is mostly based on the short-term tasks and current economic, social and political situation. Neither long-term initiatives nor short-term resolutions of Slovak government place knowledge economy and its forming among one of the priorities. As a result, also education, science and research can hardly be counted among the government's priorities when it comes to the direction of economic and social development. In addition, education, science and research and their importance for the knowledge economy is not properly reflected in the public opinions or values of individuals. The state of the affairs within the higher education, science or research system, their organization and ways of financing are not fit for the successful forming of knowledge society and the development of new economy. The occurring activities of universities, research and scientific institutions that aim to foster the knowledge society are happening not because of, but mostly in spite of the state regulation and state measures in the given fields.

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