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OUTCOMES OF INVESTMENTS IN SCIENCE AND SCIENTIFIC RESEARCH AND DEVELOPMENT – CASE OF THE REPUBLIC OF SERBIA

Abstract
The purpose of this article is to review the inputs (investments) and the results of the policy of encouraging the development of science and research in Serbia and to compare these aspects with trends in Europe (i.e., in the EU-28) and the rest of the world. Based on the analysis of data related to this topic, adopted strategic documents, implemented activities, and achieved results, it was concluded that in the field of development of science and research in the Republic of Serbia during the last decade, there has been gradual progress, but also a permanent lag concerning the average observed values in EU. When it comes to global trends and tendencies in modern science and research activities, it is noticeable that they are recognized in the Republic of Serbia, which is manifested in the general goals and directions of activities written down in laws and strategic documents. However, in the field of realization of planned activities and even more, in terms of achieving goals, there are numerous challenges, the solution of which should be worked on in the future.

Key words: public policy, science, research, Republic of Serbia, budget

1 INTRODUCTION

Contemporary concepts of society and the knowledge economy encourage the connection of different sectors (primarily the academic, government sector, and the economy), and the knowledge derived from science and research is considered an important development resource (Unger, 2022; Lilius, 2022). In

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recent times, universities, and the academic world, in addition to education and scientific research, have acquired another important role, which is to ensure a practical contribution to the realization of social needs and the achievement of society's goals (Etzkowitz, 2008). Therefore, the funding of science and scientific research is not seen as a budget expense to meet the common needs of society, but primarily as an investment, that is, an investment from which the entire society will benefit in the future.

However, the concretization of this issue opens numerous questions to which it is not easy to give a clear answer. With comparative approaches in concrete situations, it is important to establish the exact amounts of money that are used to finance this area and what exactly is meant by it (specify the meaning and correctly see the relationship of certain expressions such as educational policy, a policy of encouraging science and research, research, and development (R&D), etc.). Another issue is the sources of financing because, in addition to the public budget, the private sector is increasingly appearing as a financier of research and development. Even more challenging issues are the specific effects of financing, i.e., investments in science, that is, in research and development (R&D). Although generally speaking and judging by professional literature and reports of international organizations, it is indisputable that there is a connection between investment in science and overall social and economic development, it is not entirely clear how it can be researched and what constitutes its content in a specific situation (country).

Bearing in mind the identified problems, the goal of this paper is to point out some open questions in this area, offer possible answers, but also initiate new research and analysis of the relationship between the funds invested in the development of science and research on the one hand, and the achieved effects on society, on the other.

Accordingly, the structure of the paper was established. In addition to the first - introductory segment, which presents the background of the problem, the purpose and structure of the paper, and the methodological framework, the paper consists of five more segments.

In the second part, general issues of the economic effects of science and knowledge are explained. Economic models based on knowledge were pointed out, i.e., science and research, and the most important authors in this field. Within this segment, the amount of total public expenditure in the EU countries and the countries of the former SFRY, as well as allocations from the public budget for R&D, is shown.

The following parts of the paper are the function of answering the question (that is, looking at) these investments and the achieved effects on society in the Republic of Serbia. Although it is a challenging and complex topic, certain conclusions and answers can be reached through the consistent

application of ex-post analysis of public policy (Patton et al., 2016). Therefore, the third part gives a brief insight into the studies or analyses of public policies. In the following two parts, an analysis of this public policy is presented, within the framework of available data, available documents, and practice records. More specifically, a concise descriptive analysis (description of the goals and content of the policy) is given, as well as a simplified version of the ex-post analysis, which serves to assess the performance of the policy (monitoring and evaluation).

In the last part of this paper, the findings were discussed and current and open issues that should be worked on in the future were pointed out.

In terms of methodology, the work is predominantly based on the methodology characteristic of public policy studies. The key relationship in this area is problem-solution[3], and the basic analytical tool is the public policy cycle and the process approach (Jann, Wegrich, 2007, p. 43-62) that divides one policy into several segments (public problem, formulation of policy proposals, adoption, implementation and monitoring and evaluation of public policy performance).

1 ECONOMIC EFFECTS OF SCIENCE AND KNOWLEDGE - RESEARCH & DEVELOPMENT IN THE FUNCTION OF SOCIAL DEVELOPMENT

The dilemmas and considerations of the economic potential of education are not recent, although, in the last decade or two, it has been discussed more and more often. Economists have been intensively dealing with this issue since the middle of the last century. Considering the factors of economic growth and development, they developed theories of economic growth (The Harrod-Domar, The Solow-Swan growth model, etc.) and economic development (e.g., Schumpeter's Theory of Economic Development), searching for those factors that will have the best stimulating effect not only on the economic growth and development but also on overall social development.

One of the authors who made a very significant contribution to models of economic growth and development based on research and development, that is, the search for answers to this question, is Joseph Schumpeter. Developing the assumption about the cyclical movement of the economy, he claimed that this is a common situation rather than an exception (Mosurović Ružičić et al., 2018, p. 60). Schumpeter viewed economic development as a dynamic category that depends largely on changes in technology and on the appropriate organizational context. In this respect, he particularly pointed out the importance of innovations,

3 "Policy analysis is an applied social science discipline that employs multiple methods of inquiry to solve practical problems." (Dunn, 2018, p. xxvii).

as stimulating factors that bring about a revolution in the economic structure from within, through a continuous process of eliminating the old and creating the new. However, pointing out that innovations do not represent only technological change, but affect broader structural changes and adaptation to the new, he did not neglect the power and influence of the market (Mosurović Ružičić et al., 2018, p. 61). In other words, it is a process of mutual harmonization, on the one hand of market preferences, and on the other, of technological progress, that is, research and development, which is at the center of innovation, as a factor of economic growth and development.

Following these dilemmas, economists were intensely interested in the economic impact of investment in education (McClelland, 1966). There are numerous questions that they encountered along the way, from e.g., questions such as the analysis of the benefits of creating a plan for the health care system, if there is no adequate medical staff in the country - doctors, nurses, and their assistants, and doubts about how a certain factory can work without an adequate workforce, etc. They summed up these and similar dilemmas with one rather broad question: What is the return on investment in education compared to other investments? Certain authors (Hanushek, Wößmann, 2007) went a step further in analyzing this issue. More precisely, they focused on the quality of education and not just on mere academic achievement. Through empirical analysis, they determined that the existence of both a minimum and a high level of skills is necessary, as well as the complementarity of skills and the quality of economic institutions and, finally, a strong connection between skills and economic growth and development. In this direction, they drew several important conclusions (Hanushek, Wößmann, 2007, p. 76-79): 1. the quality of education - measured by what people know - has a strong influence on the level of individual earnings, income distribution, and economic growth; 2. the situation in developing countries is much worse than is generally portrayed based on school enrollment and school achievement alone; 3. it is unlikely that the quality of education will be improved simply by providing additional resources, but improving the quality of education requires structural changes within the institutions themselves.

Therefore, if we try to answer the question of what the return on investment in education is compared to other investments, it is certainly recommended that we first focus on encouraging education in a certain society as one of the factors that influence the supply of labor force, and therefore its expertise, competence, and skills. In this effort, we start from the assumption that higher investments in education guarantee higher work efficiency, and therefore higher productivity. By looking at the structure of the budget, and the item related to education, as a type of investment in human resources, we will get an even clearer picture. But before that, let's look at the share of public spending in GDP on an annual basis in certain European countries (Table 1).

Table 1. Annual total general government expenditure – European countries (% of GDP) 2011-2020

TIME	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
GEO (Labels)										
European Union - 27 countries (from 2020)	49.1	49.7	49.6	49.0	48.1	47.3	46.7	46.5	46.5	53.1
Euro area - 19 countries (from 2015)	49.4	50.0	49.9	49.3	48.4	47.7	47.1	46.9	46.9	53.7
Belgium	55.3	56.5	56.1	55.6	53.7	53.1	52.0	52.2	51.8	59.2
Bulgaria	33.7	34.3	37.8	43.2	40.4	34.8	34.8	36.9	35.5	41.8
Czechia	43.2	44.7	42.7	42.6	41.9	39.8	39.0	40.6	41.1	47.2
Denmark	56.4	58.0	55.8	55.2	54.5	52.5	50.5	50.5	49.5	53.4
Germany	45.2	44.9	44.9	44.3	44.1	44.4	44.2	44.3	45.0	50.8
Estonia	37.4	39.2	38.4	37.8	39.5	39.4	39.2	39.4	39.4	45.9
Ireland	47.3	42.5	40.6	37.6	29.1	28.1	26.2	25.3	24.2	27.4
Greece	55.1	56.7	62.8	50.7	54.1	49.9	48.5	48.5	47.9	59.8
Spain	46.2	48.7	45.8	45.1	43.9	42.4	41.2	41.7	42.1	52.4
France	56.3	57.1	57.2	57.2	56.8	56.7	56.5	55.6	55.4	61.6
Italy	49.2	50.6	51.0	50.9	50.3	49.1	48.8	48.4	48.5	57.1
Cyprus	42.2	42.2	43.0	49.4	40.6	37.5	36.5	42.7	38.4	45.1
Latvia	42.3	38.8	38.5	38.9	38.6	37.4	38.7	39.3	38.2	43.1
Lithuania	42.5	36.2	35.6	34.7	35.2	34.2	33.2	34.0	34.8	42.9
Luxembourg	41.5	41.8	41.2	40.6	40.4	40.0	41.3	42.1	42.9	47.2
Hungary	49.0	49.1	50.0	50.0	50.4	46.8	46.7	46.1	45.7	51.6
Malta	41.9	42.1	40.8	40.2	38.5	36.4	34.4	35.7	36.0	45.9
Netherlands	46.8	46.9	46.6	45.9	44.7	43.6	42.4	42.2	42.0	48.0
Austria	50.9	51.2	51.6	52.4	51.1	50.1	49.3	48.7	48.6	57.1
Poland	44.1	43.1	43.0	42.6	41.7	41.1	41.3	41.5	41.8	48.7
Portugal	50.0	48.9	49.9	51.7	48.2	44.8	45.4	43.2	42.5	49.3
Romania	39.6	37.6	35.6	35.4	36.1	34.6	33.5	34.8	36.2	42.0
Slovakia	41.5	41.3	42.6	43.4	45.7	42.7	39.6	39.8	40.7	45.6
Finland	53.7	55.4	56.8	57.3	56.5	55.6	53.6	53.3	53.3	57.5
Sweden	49.8	51.0	51.6	50.7	49.3	49.7	49.2	49.8	49.1	52.1
Iceland	50.5	47.7	46.0	45.8	43.5	46.4	44.4	43.8	43.3	50.5
Norway	44.2	43.3	44.4	46.3	49.3	51.5	50.5	48.8	51.6	58.5
Switzerland	32.1	32.4	33.3	32.9	33.2	33.3	33.3	32.5	32.8	37.8

Source: Eurostat (last updated 21/07/2022 23:00).

As can be seen, the values of the share of public spending in GDP in the example of European countries in the observed period range from slightly below 40% to slightly above 60%, with a slightly more noticeable increase in the last few years, which can be explained by different state measures and interventions in the fight against the COVID-19 pandemic. The following table (Table 2) presents the amounts of public spending in the former Yugoslav republics.

Table 2. General government final consumption expenditure[4] – former Yugoslav countries2012-2021(in billions of US $)

TIME	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
GEO (Labels)										
Croatia	12.34	12.65	12.74	10.61	10.82	11.55	12.82	12.82	13.7	15.21
Slovenia	9.48	9.51	9.44	8.11	8.52	8.97	9.9	9.94	11.02	12.42
North Macedonia	1.82	1.89	1.94	1.71	1.65	1.69	1.81	1.76	2.02	2.26
Montenegro	0.86	0.86	0.88	0.77	0.85	0.89	1.02	0.98	1.08	1.17
Serbia	8.22	8.66	8.5	6.51	6.51	7.13	8.38	8.56	9.33	10.59
Bosnia and Herzegovina	4.02	4.15	4.24	3.57	3.55	3.67	3.99	3.93	4.15	4.4

Source: The World Bank (accessed 05/10/2022).

To encourage and develop education, € 671 billion, or 5% of GDP, was invested in the EU in 2020 (Eurostat, 2022). Somewhat more detailed data, not only in European but also in other selected developed countries for the period from 2011 to 2020 and related to scientific research activity (research and development) are presented in the following table (Table 3).

Table 3. Annual total government budget allocations for R&D – developed countries (% of GDP) 2012-2021

TIME	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
GEO (Labels)										
European Union - 27 countries (from 2020)	0.69	0.69	0.68	0.66	0.66	0.66	0.67	0.68	0.77	0.75
Belgium	0.64	0.64	0.68	0.61	0.62	0.66	0.64	0.69	0.74	0.68
Bulgaria	0.24	0.24	0.25	0.24	0.2	0.21	0.2	0.22	0.24	0.25
Czechia	0.64	0.64	0.63	0.6	0.58	0.6	0.62	0.62	0.67	0.61
Denmark	1	1.02	1	1	0.91	0.89	0.89	0.89	0.97	0.92
Germany	0.88	0.9	0.87	0.88	0.9	0.92	0.94	0.98	1.09	1.09
Estonia	0.81	0.81	0.71	0.68	0.67	0.6	0.71	0.63	0.7	0.7
Ireland	0.43	0.4	0.37	0.28	0.27	0.25	0.23	0.22	0.23	0.22
Greece	0.39	0.48	0.44	0.52	0.54	0.5	0.62	0.7	0.89	0.89
Spain	0.6	0.56	0.56	0.56	0.54	0.52	0.52	0.52	0.62	0.6
France	0.72	0.71	0.69	0.64	0.63	0.64	0.66	0.63	0.69	0.71
Italy	0.54	0.52	0.52	0.51	0.52	0.51	0.51	0.55	0.67	0.65
Cyprus	0.36	0.34	0.35	0.33	0.32	0.31	0.31	0.35	0.54	0.39
Latvia	0.15	0.14	0.16	0.19	0.21	0.22	0.22	0.23	0.27	0.26
Lithuania	0.36	0.36	0.34	0.33	0.31	0.31	0.29	0.31	0.33	0.32
Luxembourg	0.48	0.52	0.55	0.62	0.6	0.6	0.59	0.61	0.59	0.6
Hungary	0.34	0.65	0.28	0.27	0.39	0.35	0.3	0.27	0.53	0.38
Malta	0.27	0.27	0.22	0.25	0.2	0.18	0.2	0.22	0.26	0.24
Netherlands	0.72	0.73	0.73	0.71	0.7	0.67	0.71	0.69	0.76	0.79
Austria	0.77	0.8	0.79	0.8	0.8	0.78	0.76	0.76	0.87	0.88
Poland	0.35	0.37	0.43	0.41	0.33	0.36	0.29	0.44	0.44	0.41
Portugal	0.35	0.4	0.36	0.38	0.38	0.37	0.36	0.35	0.37	0.37
Romania	0.22	0.21	0.21	0.26	0.28	0.19	0.17	0.19	0.18	0.15
Slovakia	0.4	0.39	0.38	0.41	0.37	0.36	0.37	0.38	0.42	0.4
Finland	1.03	0.99	0.97	0.95	0.84	0.83	0.84	0.84	0.96	0.88
Sweden	0.83	0.82	0.82	0.78	0.78	0.77	0.75	0.73	0.76	0.78
Iceland	0.97	1.01	0.83	0.85	0.93	0.95	0.96	0.91	:	:
Norway	0.78	0.81	0.86	0.93	1	1.03	0.98	1.02	1.15	0.94
Switzerland	0.84	:	0.85	0.87	:	0.99	0.93	0.95	1.03	0.99
United Kingdom	0.53	0.56	0.55	0.53	0.51	0.52	0.55	0.56	:	:
Turkey	0.34	0.38	0.33	0.34	0.35	0.34	0.35	0.35	0.28	0.25
Russia	0.52	0.58	0.55	0.53	0.47	0.41	0.4	0.45	:	:
United States	0.72	0.65	0.64	0.63	0.67	0.65	0.7	0.7	0.81	0.72
Japan	0.74	0.71	0.7	0.65	0.66	0.81	0.86	1.02	1.7	1.51
South Korea	1.11	1.14	1.14	1.14	1.1	1.06	1.04	1.08	1.25	1.33

Source: Eurostat (last updated 04/10/2022 23:00).

4 General government final consumption expenditure (general government consumption) includes all government current expenditures for purchases of goods and services (including compensation of employees). It also includes most expenditures on national defense and security but excludes government military expenditures that are part of government capital formation.

Therefore, we see that the participation of investments in research and development, as an important segment of the development policy of education in developed countries, ranges from 0.25% to 1.51% of GDP, in the observed period. How important this information is can be seen in the example of the former Yugoslav republics (Table 4). More precisely, an insight into this indicator, on the one hand, can explain the difference in terms of the economic development of the mentioned countries, but also their relationship to research and development, as a factor of economic growth and overall social development. Serbia, without any doubt, is on the path of growth in terms of investment in research and development, which is why it can be concluded that the economic potential of research and development, as vital segments of education policy, has been observed. However, if these values are compared with the values set aside for the research and development economic potential of education in Slovenia and Croatia, there is room and a need for additional investments in education in our country. Of course, to the extent that objective economic potentials and circumstances allow it.

Table 4. Annual total government budget allocations for R&D – former Yugoslav countries (% of GDP) 2012-2020

TIME	2012	2013	2014	2015	2016	2017	2018	2019	2020
GEO (Labels)									
Croatia	0.74	0.8	0.77	0.83	0.85	0.85	0.95	1.08	1.25
Slovenia	2.56	2.56	2.37	2.2	2.01	1.87	1.95	2.05	2.15
North Macedonia	0.33	0.44	0.52	0.44	0.44	0.35	0.36	0.37	0.38
Montenegro	0.31	0.37	0.36	0.37	0.32	0.35	0.5	0.36	:
Serbia	0.85	0.68	0.72	0.81	0.84	0.87	0.92	0.89	0.91
Bosnia and Herzegovina	0.27	0.32	0.26	0.22	0.22	0.2	0.19	0.19	0.21

Source: The World Bank (accessed 05/10/2022).

Let's go back to the question again - what is the return on investment in education compared to other investments? The answer to this question cannot be given in a short time. Due to the lack of short-term economic effects of education, one part can be understood as investments in scientific research work in the observed countries, which are around 1% of GDP. Nevertheless, despite the noticeably increased allocation from the budget in the mentioned countries, we are talking about still insufficient funds. The economic effects of education must be observed and understood exclusively in the long term for a simple reason: the human being is the basic unit of education. Hence, investing in education is investing in people, and in human capital, which represents one of the basic production factors. Investing in human capital indirectly means investing in means of work (machines, etc.), which is why we must work on developing

awareness of the importance of scientific research as an economic factor, and then on finding the possibility to gradually increase the funds allocated for education - especially research and development, as its development branches.

2 EFFECTS OF PUBLIC POLICY ON THE DEVELOPMENT OF SCIENCE AND RESEARCH - MONITORING THE PERFORMANCE OF PUBLIC POLICIES

In the previous text, it was explained why it is not possible to speak in the short term and explicitly about the economic effects of investment in education and science and the return on money. However, every public policy, including the policy of encouraging the development of science and research, can be analyzed based on postulates developed in public policy studies.[5] According to those postulates, as well as the topics of this article, goals, activities (that is, invested resources to achieve goals) and consequences can be identified as essential elements, i.e., effects. In this context, the ratio of input-output, i.e., invested funds and achieved goals, can be seen, with a note that the degree of concretization of this analysis and the precision of its conclusions depend significantly on the degree of development of a certain public policy and the availability of data.

The first step in the analysis of public policy is its description, that is, the presentation of its content, the basis of which is set goals and planned activities that should lead to the achievement of goals. Usually, this analysis is performed through the study of the institutional framework and documents that contain the mentioned elements (laws and other legal acts, strategies, action plans, etc.).
A significantly more challenging phase of the cycle and analysis of public policy is the monitoring of its implementation and achieved results. In this connection, two terms appear policy monitoring and evaluation. Although in everyday language these two expressions often appear together, and sometimes they are seen as expressions with very close or even the same meaning, in the professional literature a clear distinction is still made.

Namely, through supervision or monitoring of public policy, facts about the outcomes of public policy are obtained. More precisely, the facts about a problem before and after the implementation of an activity are considered, which are most often expressed using various indicators, indices, or numerical values (Dunn, 2018, p. 251). Examples of such data are the number of researchers

5 "Political science is also the study of public policy— the description and explanation of the causes and consequences of government activity. This focus involves a description of the content of public policy; an analysis of the impact of social, economic, and political forces on the content of public policy; an inquiry into the effect of various institutional arrangements and political processes on public policy; and an evaluation of the consequences of public policies on society, both intended and unintended." (Dye, 2017, p. 4)

(the number of employees in a certain area or relation to a million inhabitants), the number of PhDs engaged in the non-academic sector, the number of scientific works, etc. If the goal of a specific activity is to increase one or more of these parameters, then policy monitoring is the process of monitoring the implementation of the activity and the observed indicator or data. In public policy studies (Dunn, 2018, p. 259-273) several methods of monitoring public policies have been developed, such as accounting of social systems, social auditing, research, and practical synthesis.

And while the monitoring of public policy and its outcomes is factual, the evaluation is based on the overall values of a particular outcome. Therefore, it is not only about financial gains and costs but about the overall impact on society and the achievement of the general goals of society (improvement of the quality of life, environment, democracy, civil liberties, etc.). The values of a society, which are based on ethical postulates, have an important dimension of public policy evaluation (Dunn, 2018, p. 321-324).

If we return to the issue of investment policy, i.e. encouraging the development of science and research activities, we can state that it is partly possible to talk about the first two dimensions of public policy (its content and monitoring, which includes looking at the goals set and the degree of achievement), while the evaluation of this policy in terms of long-term and overall effects on society is much more difficult, because methodological complexity (which goes beyond the scope of this paper) as well as because numerous aspects of the policy are relatively new and many activities are still in the implementation phase.

3 CONTENT AND OBJECTIVES OF THE INVESTMENT POLICY IN SCIENCE AND DEVELOPMENT (R&D) IN THE REPUBLIC OF SERBIA

Article 97 (point 12) of the Constitution of the Republic of Serbia (Official Gazette of the RS, No. 98/2006 and 115/2021) states that the Republic of Serbia regulates and ensures scientific and technological development and encourages and assists the development of science. These general guidelines represent the political and legal basis for more specific regulations, i.e., laws which, although of a formal-legal and regulatory nature, also contain the basic directions of development and the general goals of some policy.

Considering the topic of this paper, the key law that represents the basis for more concrete and operational documents (strategies and action plans) is the Law on Science and Research (Official Gazette of the RS, no. 49/2019-3), which establishes the overall system of science and research.[6] It regulates the

6 The previous version of this law is the Law on Scientific Research Activity, Official Gazette of the

planning and realization of interests in the field of science and research, as well as ensuring the quality of scientific research work (Article 1). Article 2 of this Law points out that science and research are extremely important for the overall development of the country and that the future based on knowledge, together with higher education, represents the driver of economic and overall social development. Based on these criteria, it can be said that global trends and concepts such as knowledge society and the need for practical application of scientific achievements in the function of overall social development are recognized in the Republic of Serbia.

Even more important for the topic of this paper is that this Law prescribes and obliges the Government of the Republic of Serbia to adopt a Strategy for Scientific and Technological Development, which should be harmonized with the strategy of general economic and social development. It should determine: 1. the situation in the field of scientific research activity, 2. goals, 3. directions of action as well as 4. targeted funds from the budget and the economy, which are shown as a percentage of the GNI of the Republic of Serbia (Article 11).

Before looking at the general goals, it is worth mentioning that the Law on the Planning System (Official Gazette of the RS, no. 30/2018, Article 13) systematically regulates the management of public policies and the content of planning documents. It is also stipulated that as a rule, the strategy should have one general and up to five specific goals, whereby they must be clearly defined, measurable, acceptable, realistic, and time-bound.

The most important document for determining the goals of public policy in the field of science and research development is the Strategy of Scientific and Technological Development. In the Strategy for the period from 2016 to 2020, which was entitled Research for Innovation, the importance of science for the overall development of Serbia and its potential is highlighted at the very beginning, in the address of the relevant minister, but it also points to problems: insufficient funding from the budget and almost non-existent participation of the private sector, and that the influence of the scientific community on society is not great. The general goal of this Strategy is to improve the efficiency and effectiveness of the scientific research system through:

a) "Creating new knowledge, developing new and improving existing technologies, solving complex social and economic problems and defining the country's economic specialization, and
b) Education of high-quality research personnel who will be able to use their knowledge and scientific research work to create new values, design and generate economic and overall social development".[7]

RS, no. 110/2005, 50/2006 corrected, 18/2010, and 112/2015.

7 Research for Innovation - Strategy of Scientific and Technological Development of the Republic of Serbia for the period from 2016 to 2020, Ministry of Education, Science and Technological De-

In addition to the general goal, six specific ones were also determined (Ibid., p. 8):

1. encouraging the excellence and relevance of scientific research in the Republic of Serbia;
2. strengthening the connection between science, economy, and society to encourage innovation;
3. establishment of an efficient system of science and innovation management in the Republic of Serbia;
4. ensuring excellence and availability of human resources for science and economy and social activities;
5. improvement of international cooperation in the field of science and innovation;
6. increasing investment in research and development through public funding and encouraging business sector investment in research and development.

Furthermore, the Strategy elaborates on activities that should lead to the achievement of special goals. Indicators of the success of specific activities were also defined, but it is noticeable that in many cases the target value was not given. Although this is a kind of shortcoming, the content of the strategy still provides a solid basis for subsequent monitoring of results.

In the new Strategy for the period 2021-2025, which is called the Power of Knowledge (Official Gazette of the RS, 10/2021-3), an insight into the degree of achievement of the goals from the previous strategy (which will be discussed later) was given and new goals were set. The general goal is that: "The scientific, technological, and innovation system contributes to the accelerated development of the Republic of Serbia through the improvement of the quality and efficiency of science, technological development, and innovation and further integration into the European research area, thereby helping to reach the standards of developed economies." What is noticeable concerning the goal from the previous strategy are two novelties. Firstly, the importance of innovation is highlighted and secondly, the goal is to integrate into the European Research Area and reach the standards of more developed economies. This commitment indicates that the comparison with European developed countries is an important indicator of the success of this policy in Serbia. The specific goals of this Strategy are:

1. Providing the necessary conditions for the dynamic development of science, technological development, and innovation.
2. Increasing the efficiency of using the resources of the scientific research system.
3. Nurturing the top quality of science and technological development and

velopment of the Republic of Serbia, Belgrade, 2016, p. 8.

strengthening the competitiveness of the economy.
4. Focusing research on social challenges and priorities.
5. Strengthening international cooperation.

4 REALIZATION AND ACHIEVED RESULTS - MONITORING OF SCIENTIFIC POLICY IN SERBIA

The first question when monitoring public policy is whether, in general, activities are undertaken to achieve the declared goals or whether they are just a "dead letter on paper". Realized activities in the public sector, in the past years, in the field of financing science and research in the Republic of Serbia can be seen as an indicator that in practice the set goals are being realized (with the caveat that it is debatable whether and to what extent the goals were achieved). In this sense, the Law on the Science Fund of the Republic of Serbia (Official Gazette of the RS, no. 95/2018) should be mentioned, which established the Science Fund in March 2019, whose work can be considered an important activity in the field of achieving the set goals. The Fund's programs are compatible with set priorities and general trends such as connecting science and economy, support for young researchers, support for projects in the field of artificial intelligence development, etc.

At the end of 2022, it is evident that over 1,700 researchers have participated in 282 approved projects, the total value of which is close to 44 million EUR (Bulletin, 2022, p. 3).

Of course, these are not the only investments and projects financed from the budget. Science and technology parks in Serbia are also important indicators. The first park was created in 2015 in Belgrade with significant financial support from the budget of the Republic of Serbia, and then they were built in Niš, Čačak, and Novi Sad. Judging by official announcements, this trend of funding science and research should continue in the future. Investments of around 190 million EUR are announced for the Campus Bio4 project alone (RTS, 2022).
Therefore, viewed globally, it is not disputed that certain activities in the field of scientific development and research are being implemented and that significant financial resources are being invested. They are gradually increasing, and most parameters show that there is slight progress in the field of science and research (e.g., number of scientific papers, citations, participation in international projects, etc.).

However, as a counterargument to this point of view, it can be stated that science and research are still significantly behind compared to this area at the EU level (Table 5). It is also evident that many strategic goals have not been achieved. It is not yet possible to speak objectively about the achievement of the goals of the current strategy, since it is still being implemented. But when

the achievement of the goals from the previous strategy is considered, it can be stated that the performance is mediocre or even weak. Namely, out of a total of 34 measures (which were related to six special goals), only 11 of them were achieved, 13 of them were partially achieved and 10 of them were not achieved at all (The Power of Knowledge Strategy, 2021).

Also, if we analyze the data that indicate the main goal of the strategy, which is integration into the European Research Area and reaching the standards of more developed economies, it is evident that Serbia is still far from achieving the set goals.

Table 5. Comparison of Scientific and research results Serbia – EU 28 from 2009 to 2019

	EU-28	*Serbia*
Investment in science and development as a % of GDP (2009-2019)	About 2%	Less than 1%
Number of researchers per 1000 inhabitants (2019)	4,25	2
Number of scientific papers per million inhabitants	2000	1200
Citations per million inhabitants	68 000	31000

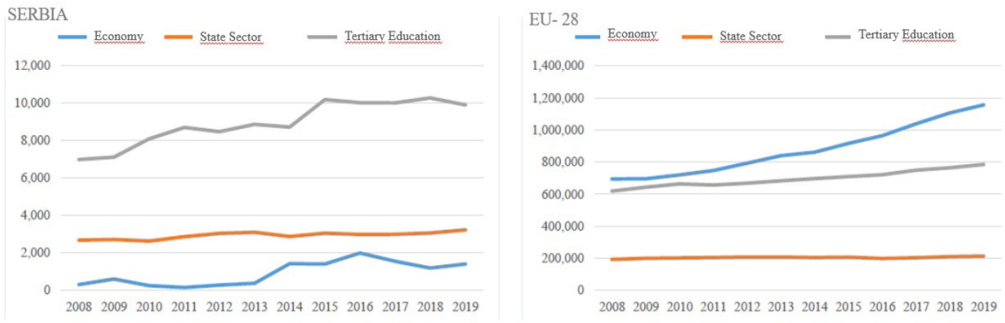
Source: Strategy of scientific and technological development of the Republic of Serbia for the period from 2021 to 2025 "Power of knowledge", Official Gazette 10/2021-3. Note: the displayed data is obtained by rounding the authors. For a more precise insight, see the Strategy.

From the data presented, it is evident that science and research in Serbia are still significantly below the average in the EU. It is somewhat encouraging that when these data in Serbia are viewed in the time dimension (2008-2019), slight growth is evident (except for investment, which is constantly below 1% of GDP). However, progress i.e., growth is also noticeable at the EU-28 level, which means that despite the slight progress of science and research in Serbia according to the stated standards, it does not catch up with the standards in the EU. Moreover, according to the latest reports from 2022, the average investment at the EU level in research and development is 2.3%, while the business sector invested as much as 205 billion EUR in 2020 (European Commission, 2022, p. 294).

Data on the number of engaged researchers by sector are also very indicative. The number of researchers who work in three sectors: academic (tertiary) education, the state sector, and the economy is presented in Chart 1. There is a significant difference when comparing Serbia and the EU-28. Namely,

while Serbia has by far the highest number of researchers in the academic (tertiary) education sector, in the EU, most of them work in the economic sector. This is also a kind of guideline for the future policy of science and research in Serbia, which is its even more intense connection with the economy. More detailed data is given in the chart below:

Chart 1. The number of engaged researchers by sector in the period 2008-2019



Source: Strategy of scientific and technological development of the Republic of Serbia for the period from 2021 to 2025 "Power of knowledge", Official Gazette 10/2021-3.

Related to this, the question of defining the country's economic specialization remains. Namely, it is a goal from the previous strategy for the period 2016-2020, which was not mentioned in the current one. Therefore, it is not determined whether this goal has been achieved or not, although the issue of economic specialization is extremely important in the modern conditions of globalization and connectivity of the whole world. The impression is that this topic has not been discussed enough with the public, but it should also be noted that 2020, the Smart Specialization Strategy was adopted for the period from 2020-2027 (Strategy of smart specialization in the Republic of Serbia for the period from 2020 to 2027). It states as a vision and desired state that in the future Serbia will be recognizable in the world in four fields: 1. food for the future (food with added value through a partnership based on knowledge), 2. information and communication technologies (sophisticated software solutions and services for the global market), 3. machines and production processes of the future (industrial innovations based on industrial and cross-sectoral cooperation) and 4. creative industries (based on the creativity of individuals). It remains to be seen whether and to what extent these goals will be realized in reality.

CONCLUDING REMARKS

Based on the presented content, it can be concluded that the policy of encouraging the development of science and research in the Republic of Serbia follows global trends and tendencies (knowledge society) and that the goals are set in that context. Also, activities accompanied by significant financial resources are evident. Although the goals set in the strategic documents were only partially achieved, based on the indicators that indicate the development of the scientific research system (number of scientific papers, citations, innovations, international cooperation), it can be stated that during the last decade, there has been a constant, indeed slight, progress.

However, what is not encouraging is that if the observed indicators and funding are compared to the average values in the EU, science and research in Serbia are constantly lagging (since European science and research are also progressing, and investments are gradually increasing).

Accordingly, if the goal is to bring Serbian science and research closer to European standards, it is necessary to further increase investment and especially encourage the private sector to invest in research and development.

Related to this, there are very indicative data, according to which the number of engaged scientists in the economy is very low compared to EU countries, where this number has been growing significantly for the last few years. The question arises why the number of engaged scientists in the economy in Serbia is so small, what are the consequences of this situation and how can this situation be improved? The question arises whether the small number of scientists engaged in the economy is a consequence or a cause of insufficient connection between the academic and economic sectors. The answers to these questions should be the subject of future analysis and research in this area.

Another important note is that the data on science and development in the Republic of Serbia mostly refer to science in general. However, if a more detailed insight were to be carried out and the sciences classified according to various criteria, e.g., to the natural-technical and social-humanistic or by the degree of applicability of their knowledge (directly applied and theoretical) and the like, a more accurate picture of the needs and problems in various sciences would be obtained. It would also be a better basis for developing better public policies in this area

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