THE CONTRIBUTION OF STRUCTURAL FUNDS FOR THE BUILDING AND DEVELOPMENT OF RESEARCH INFRASTRUCTURE IN THE SLOVAK REPUBLIC

PhDr. Vladimír KOVÁČIK, PhD. [1]*

[1]*Faculty of Social Sciences, The Department of the Public Politics and Public Administration*
University of Ss. Cyril and Methodius in Trnava, Bučianska 4/A, 917 01 Trnava
* *Corresponding author E-mail address: vladimir.kovacik@ucm.sk*

Abstract
The Slovak Republic has the opportunity to implement the EU Structural Funds since 2004, when it joined the EU. The area of research and development support in Slovakia has long been underestimated. The EU Structural Funds make up the most significant part of R&D expenditure in Slovakia The main objective of this article is to analyse the impact of the implementation of EU Structural Funds on the construction, support and development of research infrastructure within all three programming periods in the Slovak Republic. To achieve the objective, the methods of analysis, synthesis, deduction and induction have been used. In the shortened programming period 2004-2006, this area was only partially supported by the EU Structural Funds and R&D did not form a full priority for this type of funding. In Slovakia, in 2007 - 2013, the R&D Operational Program was the dominant source of funding for research, development and innovation from the EU Structural Funds, in particular by supporting the development of research infrastructure. The research and development potential in Slovakia can be fully developed in the current programming period 2014-2020 by the OP R&I.

Keywords: EU Structural Funds, Research Infrastructure, Operational Program, Programming Period, Research, Development and Innovation, Implementation of Projects

JEL Classification: O32, R11.

1. Introduction

The support of research and development (R&D) is a key driver of any knowledge-based, dynamically developing society. R&D in general is the pillar of the knowledge economy and ensures its competitiveness. At the same time, it guarantees new solutions to many problems and a source of high quality knowledge. The performance of the economy is significantly - albeit indirectly - influenced by science and research. Empirical analyzes show that investing in education, science, research, development, innovation and new technologies are investments in economic growth and are key to the country's long-term competitiveness in a globalized world (Gonda, 2007). Efficient domestic R&D, the innovative capacity of the economy and the use of information and communication technologies (ICT) are a prerequisite for a higher level of assessment of well-being, economic growth and employment (Morvay et al., 2017).

Likewise, support of innovation plays a key role in ensuring sustainable economic development. There are many definitions for the innovation, but in general it is a solution to the problem in a new, innovative way (for example idea, method or device). The importance of innovation is growing in the context of a globalizing economy, the gradual emergence of larger national and multinational trading companies, with increasing competition on domestic and global markets, with growing demands for managerial activity (Čajka, 2006). Innovation can also be seen as an event occurring at a certain point or place that causes a market or organizational breakthrough (Buček, 2006).

Innovations have written the history of mankind since the great industrial revolution, when the steam engine has enabled population mobility. Since then, innovation has become a driving force for economic development and a decisive factor in the competitive struggle of companies. Innovation activities such as research and development can be seen as a driving force for the development of the economy, as they develop the potential for future competitiveness in the form of new knowledge, increase the efficiency of the economy and its ability to operate, especially through small and medium-sized enterprises (Ministry of Economy, 2007).

In today's world of technology and rapid progress, the ability to innovate distinguishes leaders from followers and those who survive from those who disappear. As a result, in the 21st century we are experiencing innovation in all areas and sectors. Successful innovators are not only those who have ideas, but especially those who can turn these ideas into marketable forms. The investments in the area of R&D are not a case of luxury; in fact it’s quite the opposite as it’s the only way how to ensure the long term sustainability, prosperity and economic development.

The basic problems of Slovak R&D are low expenditure and the fragmentation of the R&D system. The level of public and private R&D expenditure is among the lowest in the European Union (EU) in the long term. In Slovakia, the share of high quality research publications is relatively low, as well as the low patenting activity. The cooperation between the universities and research centers with business in the field of research is also not as high as it could be due to relatively weak support of private R&D in the Slovak legislation. In 2015, there were some improvements made by the government in this area as the hybrid tax allowance was introduced, that was set at a rate of 50 % to labour costs and at a rate of 25 % to other qualifying expenditures. Another significant problem is that the private investments in R&D are on the very low level. The R&D investments relies highly on foreign sources of funding, most notably the EU funding. The level of R&D infrastructure is insufficient in qualitative and quantitative terms in the long term. At the same time, R&D cannot be realized without the existence of high-quality human resources and without high-quality technical equipment. Research, development and technological innovation are indispensable and the greatest source of high quality knowledge. They are the pillar of every knowledge economy. R&D is a basic prerequisite for maintaining the steady development of the economy and competitiveness of the Slovak Republic (SR) in the long term. The basic precondition for a competitive implementation of research, development and innovation (R&D&I) is to ensure sufficient financial resources.

Research infrastructures are considered a fundamental element of scientific advancement and technological development. Their existence is able to provide the necessary favorable environment for the production of breakthrough discoveries. They include a wide range of sophisticated and modern facilities, devices, resources or related services, used by research disciplines of varying focus on conducting research on outstanding scientific value and recognition. They encourage the development of science culture by opening up opportunities to educate, retain and attract highly qualified experts and build strong teams of national and global importance. Beyond the scientific dimension, research infrastructures are crucial to the sustainable development of an innovative industry, supporting its higher performance, which can translate into positive economic and societal trends.

Developing a high-quality national R&D support system in which high-end research infrastructures are centers of excellent research requires strategic decisions at national level to coordinate investment priorities and initiatives. Investigating the strengths of the research base will enable the R&D policy ambitions to be directed and to focus investment in selected areas of national interest. In the long term, continuous investment in building, improving or maintaining research infrastructures means a return in the form of added value effects for future growth.

Before 2007, in fact there was no system of R&D support in Slovakia comparable to other EU countries. As a result of long-term low R&D funding and the society's overall attitude to research, technical infrastructure has become significantly obsolete. The SR had the opportunity to draw funds from EU Structural Funds since its accession to the EU in 2004. The low level of R&D funding before 2007 was caused by several factors. The primary problem was due to the fact that the state budget (given the preference of other priorities) did not have sufficient financial resources to cover R&D infrastructure needs and in terms of funding from the EU Structural Funds, in the shortened programming period 2004-2006 this area was only partially supported and R&D support wasn't formed in the coherent framework for funding.

The Slovak research and development ecosystem has undergone extensive material and ideological transformation over the last decade, inspired by international trends in the position and use of research infrastructures as a driving force for innovative and socio-economic progress. In 2007-2013, the SR's priority in this area was to mitigate technological, research and organizational barriers to fully exploit the potential of our top research institutions. The creation of an environment conducive to the realization of excellent research, in which modern and technically most advanced research infrastructures would form the basis for the performance of scientific institutions of the SR, was the main objective in the 2007-2013 programming period.

This concept of mitigating the vast technological gap between equipment of our research institutions compared to the international standard and the process of rebuilding and developing research infrastructures would not be feasible without large-scale investments, mainly due to EU funds and our EU membership. Similarly, in the 2014-2020 programming period, the R&D support area is a coherent framework of funding, through which EU funding provide significant resources for sustainability and development of the built infrastructure system. The challenge in this programming period remains the effectiveness of spending these resources, as the course of its implementation raises a number of questions over the relevance of their use.

The main objective of this article is to analyze the impact of the implementation of EU Structural Funds on the construction, support and development of research infrastructure within all three programming periods in the SR. We have set the main hypothesis that the 2007-2013 programming period provided a key contribution to the

building, support and development of research infrastructure in the SR, as the first programming period 2004-2006 was shortened and the R&D support area did not have a comprehensive support framework.

In the 2007-2013 programming period, the situation was completely different, as 1,209 billion EUR was allocated for the area of R&D support from the European Regional Development Fund (ERDF) for the Operational Program R&D (OP R&D). At the same time, we assume that although the implementation of the 2014-2020 programming period has been under way for the sixth year now, the level of drawdown achieved so far has not been able to fully ensure relevant (and desirable) progress in the building and development of scientific infrastructure in Slovakia. To confirm the main hypothesis, we will also analyze the development of drawdown of the OP R&D in individual years of implementation in relation to the indicator of R&D expenditure as the % of GDP in the SR in the 2007 – 2017. To achieve the objective, the methods of analysis, synthesis, deduction and induction have been used.

2. R&D support in Slovakia

The area of R&D support in the SR in terms of the volume of funds is undersized in the long term. In 2011, total R&D expenditure was only 0.63% of GDP, with a EU15 average of 2.12% and an average of V4 countries of 1.27% (Eurostat, 2017). This is mainly due to the long-term low level of private R&D investment. Since 2005, the industry's share in financial R&D stimulation has declined from 54% to 35% and in 2010 it was only 0.27% of GDP.

By 2020, in line with the Europe 2020 strategy, SR wants to increase the share of R&D expenditure to at least 1.2% of GDP, so that the share of public and private resources is 1: 2. To achieve this, it will be necessary to increase private investment in R&D by strengthening research centers' cooperation with businesses, as well as consolidating and expanding the R&D infrastructure. However, according to current developments in R&D spending, these plans appear to be too ambitious, especially the increase in private sector share of R&D investments, which are very low in EU Member States in the long term and would require unprecedented growth in line with the goals set in the strategy, what is not a very realistic scenario (Gross & Roth, 2012).

One of the key documents in Slovakia that defines the R&D support system is The Smart Specialization Strategy, which was adopted in 2013 on national level. Since 2013, very limited progress has been made toward approving and implementing the Action plan for this strategy, as the main problem was to reach agreement on the areas of specializations and on the system of governance of R&D; both were approved by the government in 2016 and 2017.

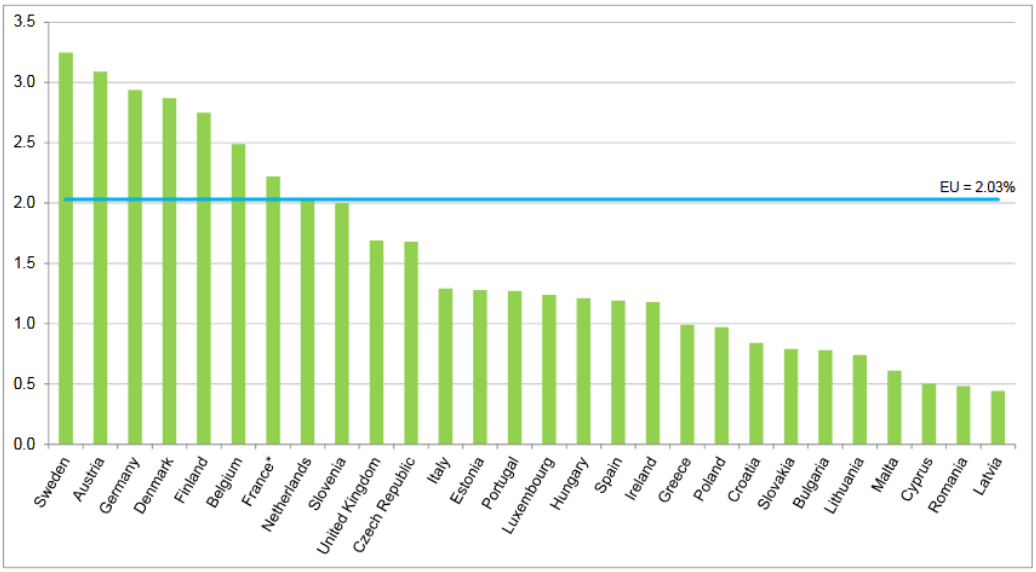
Table 1: *R&D expenditure in 2006 compared to 2016*

	R&D intensity (in % of GDP)		R&D expenditure (in mil. EUR)	
	2006	2016	2006	2016
EU average	1,76	2,03	216 330	302 220
V4 average	0,81	1,16	1 039	2 261
Czech republic	1,23	1,68	1 527	2 963
Hungary	0,98	1,21	900	1 327
Poland	0,55	0,97	1 513	4 112
Slovakia	0,48	0,79	217	641

Source: own preparation based on Eurostat (2017)

The R&D expenditure in Slovakia is among the lowest in the EU in long term. According to Eurostat, Slovakia allocated 0.79% of GDP to R&D in 2016. Thus, among the V4 countries, the Slovak level of these expenditures is the lowest. By comparison, the Czech Republic allocated 1.68% of GDP for R&D, in Hungary it was 1.21% of GDP and in Poland it was 0.97% of GDP. The European R&D expenditure target was set to 3% of GDP in line with the adopted Europe 2020 strategy.

Fig. 1: *R&D intensity in EU member states in 2016 (in % of GDP)*



Source: Eurostat (2017)

In 2016, according to Eurostat, the highest intensities of R&D expenditure were achieved in Sweden (3.25%) and Austria (3.09%). They are closely followed by Germany (2.94%), Denmark (2.87%) and Finland (2.75%). One of the reasons for this situation is that R&D funding from public sources prevails in Slovakia, with most of them coming from the EU budget. Sustainability of public funding will be problematic when EU funding for research infrastructure is reduced (Vokoun, 2016).

The priority of the Europe 2020 strategy is to achieve growth that is: smart - through more efficient investment in education, research and innovation; sustainable - through a low carbon economy; and inclusive - with a strong focus on job creation and poverty combating. The strategy sets five ambitious targets for employment, innovation, education, poverty combating and energy (European Commission, 2018).

In its Smart Growth Priority, Europe 2020 strategy aims to create a knowledge-based economy and innovation. It does so by creating favorable conditions for innovation, education and research so encouraging R&D and knowledge-intensive investment and moves towards higher value added activities. It can so help meet the major challenge for Member States and regions of increasing innovation capacity and R&D in businesses and strengthening their links with universities and research centers (European Commission, 2018).

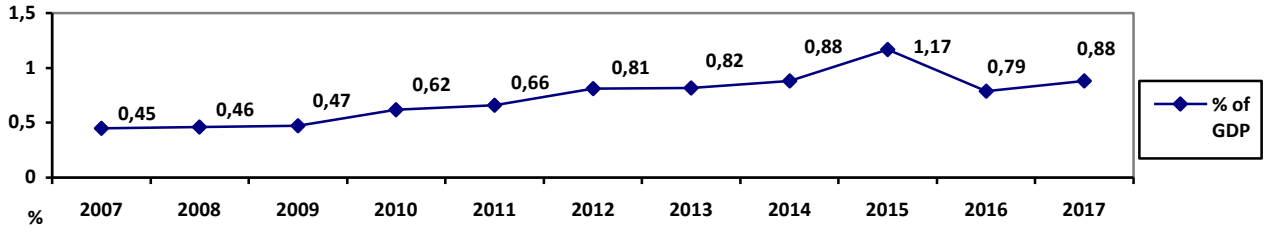
Although the European Commission has set some brave targets regarding the amount and structure of R&D expenditures (for example objective set in the Lisbon Strategy to invest 3% of GDP to R&D spending, 2/3 of which should be realized by private funding), in reality most of the Member States are struggling to achieve these objectives.

There are two specific groups of Member States, which are struggling to keep pace with the wealthier countries of Western and Northern Europe in long term regarding the amount of R&D spending and the structure of the expenditures. The first group includes the Mediterranean countries Greece, Italy, Portugal and Spain and the second group includes the New Member States that have become full member of the EU in 2004 and 2007.

Based on the experience in the EU, we can say that there is a generally acknowledged fact that R&D expenditure rises exponentially with the level of development measured by GDP per capita. The wealthier a country or a region is, the more sources are spent on R&D.

The main challenges of the smart growth objective of the R&D strategy in Slovakia are the overall increase in research spending and the change in R&D funding structure. R&D intensity in Slovakia increased significantly from 2007 to 2015, from 0.45% to 1.17% of GDP (Eurostat, 2017). However, this result was still well below the target level, mainly due to the exceptionally low R&D expenditure of private enterprises (0.33% in 2014; Eurostat).

Fig. 2: *Research and development expenditure in Slovakia (in % of GDP)*



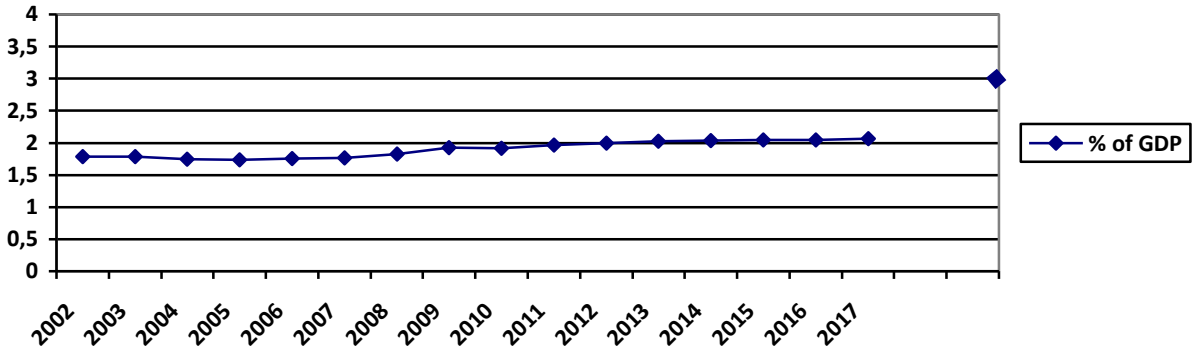
Source: own preparation based on Eurostat (2017)

R&D in the context of the Europe 2020 strategy is based on assumptions about the key role of knowledge in ensuring smart growth. According to the EC projections, in 2010-2060, technological and non-technological innovation should account for up to two thirds of overall economic growth. Research and innovation-driven economic growth is a prerequisite for the long-term sustainability of the public service system in healthcare, pensions and social services (European Commission, 2012).

As innovation performance is conditional on the country's economic maturity, further development of R&D and innovation also depends on the future economic growth and development of economic structures in Slovakia (Šikula, 2010). Insufficient expenditure on R&D in long term is also related to the so-called brain drain from Slovakia abroad.

In the context of the Europe 2020 strategy, support for basic and applied research and development creates a strong precondition for building a knowledge-based economy, contributing to employment growth and thus to the overall economic growth of the whole euro area.

Fig. 3: *Percentage of R&D expenditures as % of GDP for the EU in 2002-2017 and Europe 2020 strategy target*



Source: own preparation based on Eurostat (2018)

The Europe 2020 strategy aims to increase spending on R&D activities up to 3% of GDP across the EU, which, together with education, contributes to the "smart growth" of EU Member States (European Commission, 2018).

Despite the fact that the Europe 2020 strategy target of increasing spending on R&D activities up to 3% of GDP by 2020 is still very questionable, it is positive that this level has not decreased even during the economic crisis. On the contrary, it continues to increase, albeit at a minimum level (in 2016 and 2017, the EU average was 2.03%).

R&D&I infrastructure is a prerequisite for increasing the technological and innovation level of the economy while effectively transferring technology. Long-term under-financing of R&D infrastructure financing from the state budget in Slovakia has created a technological debt to R&D institutions. Therefore, after the accession of the SR to the EU in 2004, the renewal process of the scientific and research infrastructure was a substantial part of the implementation of the Structural Funds in Slovakia, thereby partially reducing this deficit.

Although the implementation of the Structural Funds in Slovakia started in 2004, the technological debt in R&D institutions wasn't significantly removed until the beginning of the implementation of the programming

period 2007-2013, when major construction and modernization of research infrastructure was launched, especially in universities and public R&D institutions.

3. R&D support in the programming period 2004-2006

Before 2007, there was no comprehensive system of support for R&D&I comparable to other EU countries in Slovakia. In the shortened programming period 2004-2006, which was the first period when the SR could draw EU Structural Funds, this area was only partial supported from these sources and R&D&I support wasn't formed in the coherent framework for funding.

In the shortened programming period 2004-2006, the SR had a National Development Plan that consisted of a number of sectoral operational programs, programming documents and community initiatives. From the perspective of research and innovation, the Sectoral Operational Program Industry and Services was the most important for the country, under which the priority "Growth of competitiveness of industry and services using the development of domestic growth potential" was addressed by promoting entrepreneurship, innovation and applied research.

This priority included several measures. The measure "Promotion of Entrepreneurship, Innovation and Applied Research" was the most important for the R&D&I support. Under this measure, 93 projects were submitted, of which 59 projects in the amount of 6.9 million EUR were approved and received a financial contribution.

The main objective of the projects was to ensure the growth of the competitiveness of the Slovak industry by supporting research and development, the acquisition of new innovative technologies, processes and products, and also to promote cooperation between universities and research institutes. The innovative environment has been promoted through industrial development and research, technology transfer, know-how, innovative products and processes. These projects were aimed at supporting small and medium-sized enterprises (SMEs), small-scale projects with limited impact for the beneficiary itself, and thus no strategic investments were made in research infrastructure. The amount of financial support for projects was limited by the fact that it was set for SMEs, where projects are co-financed under the State aid scheme and with the lower level of intensity. According to the rules for projects financed under the state aid scheme, the amount of contribution is limited because state resources are used to provide assistance that gives organizations an advantage over others.

We do not consider the implementation of the programming period 2004-2006 to be particularly important in the area of R&D support in terms of the volume of funds that were implemented within this programming period as well as in terms of the contribution of the implemented projects to the strategic research and development infrastructure. The greatest benefit of the implementation of shortened programming period 2004-2006 is that it provided the necessary experience for the Managing Authorities and other institutions in Slovakia for the implementation of next programming periods.

4. R&D support in the programming period 2007-2013

In 2007 - 2013, the Operational Program Research and Development (OP R&D) financed by the EU Structural Funds was the dominant source of R&D&I funding in Slovakia. In particular, the OP R&D supported the construction of research infrastructure in all regions and in all sectors.

The OP R&D is a programming document on the basis of which support for R&D activities and infrastructure of universities was provided in 2007-2013.

The operational program is mainly aimed at modernization and increase of effectiveness of the support system for research and development and improvement of universities' infrastructure in such a way that they contribute to the economy competitiveness increase, regional disparities decrease, creation of new innovative high-tech SMEs, creation of new jobs and improvement of conditions of the educational process at universities.

Being the basic condition for further progress of R&D, the quality and standards of education provided at universities is related to the conditions of buildings and facilities, in which the educational process is delivered. The value and accessibility of education has long been affected by the lack of investment in the technical and internal facilities of schools. The consequence is an unsatisfactory technical state of a high number of buildings, moral and physical obsolescence of technical equipment, high operational costs and a lack of modern technology used in the educational process at universities (The Research Agency, 2018).

OP R&D measures in the area of building and renewing R&D infrastructure were aimed at monitoring the provision of employment (not only through direct projects financed from EU funds, but mainly by building up the innovation capacity of the SR) in order to strengthen the competitiveness of enterprises operating in Slovakia and developing new businesses with good competitive potential.

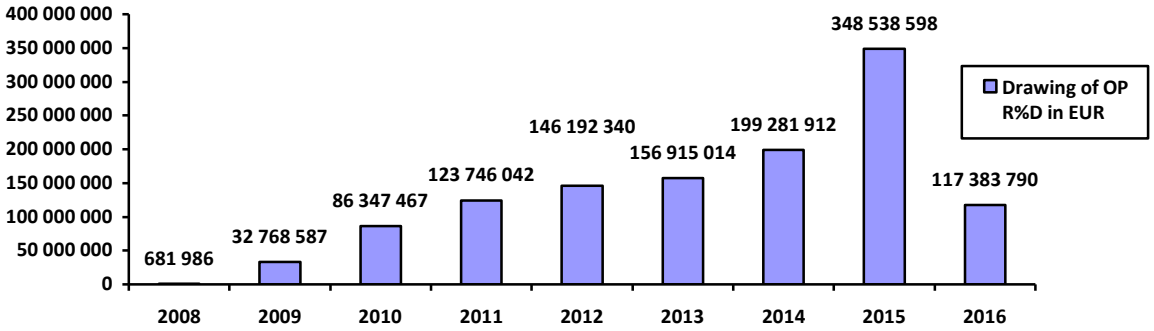
In Slovakia, the OP R&D was the primary source of R&D funding in 2007-2013. Before 2007, there were practically no major research centers in Slovakia and no real system of financing, respectively at least a system leading to the creation of such centers comparable to some other EU countries.

The Managing Authority for OP R&D in the programming period 2007-2013 is the Ministry of Education, Science, Research and Sport of the Slovak Republic. The Intermediate Body for the OP R&D in the programming period 2007-2013 is the Agency for Structural Funds of the EU - ASFEU, which was renamed The Research Agency in 2015.

In terms of R&D expenditure (one of the key indicators of national innovation development), the SR is characterized by a long-term under-funded R&D sector. Before the start of the 2007-2013 programming period, total R&D expenditure was around 0.5% of GDP, rising over the years. This increase was due to an increase in capital expenditure on equipment, which is mainly the result of drawing on Structural Funds for R&D. If we compare total R&D expenditures in other European economies, Slovakia is one of the lowest spending countries.

The OP R&D was implemented by 5 priority axes in the 2007-2013 programming period. The financial contribution for this operational program is EUR 1 209 415 373.

Fig. 4: *Drawing of OP R&D in programming period 2007-2013 in EUR*



Source: Ministry of finance of the SR (2018)

By the end of the programming period, overall 1412 grant applications in the total amount of EUR 3 662 137 885 were submitted in 47 calls, which were launched by Managing Authority and Intermediate Body.

Overall, 560 projects have been contracted in the total amount of EUR 1 617 895 284 in the programming period. Drawing of EU funds within OP R&D as at 31 December 2016 totalled EUR 1 211 855 749, while the share of EU funds in the total allocation reached the level of 100.20%.

In the 2007-2013 programming period, overall 491 projects (except the Technical Assistance projects) were supported by the OP R&D:

- 107 projects to support centers of excellence,
- 134 applied research projects for the public sector,
- 99 applied research projects for the private sector (of which 8 competence centers and 56 research and development centers),
- 72 universities infrastructure projects,
- 46 R&D infrastructure projects,
- 2 JEREMIE projects,
- 17 national projects,
- 14 university science park projects and research centers.

University science parks and research centers are considered to be the most significant investments in R&D infrastructure, both in terms of financial allocation and importance. University science parks are research institutes of the best Slovak universities, respectively Slovak Academy of Sciences, where top-quality applied research will be implemented and the transfer of knowledge from academia to economic and social practice through technology transfer (licensing, spin-off, or other forms of knowledge processing).

The university science park is a complex project that focuses on the systematic development of key scientific institutions; builds multi-purpose research buildings; creates space for the acceleration of ideas and incubation of

innovative companies through the implementation of applied research; it has a high-quality, efficient scientific management, based on good experience in reputable science parks, ensuring quality management and sustainability. Besides providing support of the R&D it also provides a development impulse to the region.

Research centers are less complex in nature compared to university science parks, in terms of territory development or scope. Research centers are mainly focused on supporting top-level laboratories built in a particular science area for the best research institutions to improve the quality and prestige of R&D in areas relevant to social and economic practice. They have high quality, efficient scientific management, based on good experience in reputable centers and ensuring the quality management and sustainability of the research center. They support the improvement of the interconnection of domestic and foreign research and help Slovak institutions to participate more actively in international R&D activities.

5. R&D support in the programming period 2014-2020

The Operational Program Research and Innovation (OP R&I) is a joint program document of the Ministry of Education, Science, Research and Sport of the Slovak Republic and the Ministry of Economy of the Slovak Republic for the aid from the European Structural and Investment Funds in the program period 2014 - 2020 in the area focused on creating a stable environment favorable to innovation for all relevant actors and to help increasing the efficiency and performance of R&D&I system as an essential pillar to boost competitiveness, sustainable economic growth and employment (The Ministry of Education, Science, Research and Sport of the Slovak Republic, 2018).

The OP R&I follow the OP R&D and the Operational Program Competitiveness and Economic Growth from the programming period 2007 – 2013.

The total allocation for OP R&I from EU sources is EUR 2 266 776 537 of which more than three quarters of all funds are intended to strengthen research, technological development and innovation, and the rest is allocated to support the enhancement of SMEs competitiveness.

Regarding the implementation of the OP R&I in current programming period, in our opinion it is not running well despite the fact that it is already under way for the sixth year now. As of 31 December 2018, only 9.56% of the allocation was spent within the R&I, which represents EUR 210 655 915 as the EU source. At the same time, it should be it should be kept in mind that this drawdown figure of 9.56% is also shared by both the Ministry of Education and the Ministry of Economy. In addition, according to Ministry of Finance of the SR, the Managing Authority has been unable to draw some of the funds that were expected to be spent in 2017 and 2018 on projects within the OP R&I. In particular, there was an automatic decommitment of EUR 27 million in 2017 and EUR 80 million in the 2018, which means these resources are definitely gone and cannot be spent in Slovakia anymore.

The Ministry of Education, Science, Research and Sport of the SR, which implements the priority axes 1 and 2 within the OP R&I, is responsible for the R&D support area itself. Regarding the drawing of these two priority axes, as of the 31 December 2018 only 7.34% and 5.02% respectively of the allocation has been spent. The priority axes 3 and 4, under the responsibility of the Ministry of Economy, which are aimed at supporting innovation and competitiveness of the SMEs, are drawn at the level of 14.04% and 13.86% respectively.

Based on the above mentioned data regarding the implementation of the OP R&I in the programming period 2014-2020, we came to the conclusion that in terms of the objective of our research, i.e. the impact of the implementation of operational programs on building, supporting and developing research infrastructure this programming period has not yet had a significant impact on the analyzed area, despite the fact that the implementation of the 2014-2020 programming period has been under way for the sixth year now.

The only projects that are being implemented in this programming period that we consider to provide a significant contribution to the system of Slovak research infrastructure so far are the two national projects of the Slovak Centre of Scientific and Technical Information (CVTI SR), namely the projects of Horizontal ICT Support and Central Infrastructure for Research and Development and also Research and Development Information System - access to databases for the needs of research institutions.

6. Results and discussion

The main objective of this article was to analyze the impact of the implementation of EU Structural Funds on building, supporting and developing research infrastructure within all three programming periods in the Slovak Republic. For this purpose, we analyzed a number of facts, in particular the amount of funds invested in R&D in individual programming periods, as well as the relevance and importance of implemented projects, the financial allocation of individual projects and the results achieved by projects.

We have also set the main hypothesis that the 2007-2013 programming period provided a key contribution to the building, support and development of R&D infrastructure in the SR.

In order to confirm the main hypothesis that the 2007-2013 programming period was the most beneficial for the building, support and development of research infrastructure in the SR, we have also analyzed the development of the OP R&D in individual years of implementation in relation to the R&D expenditure intensity as % of GDP in Slovakia in the period 2007 - 2017. The intensity of R&D expenditures in Slovakia increased significantly from 2007 to 2015, from 0.45% to 1.17% of GDP.

As we have already stated, in 2007 - 2013 programming period the OP R&D was the dominant source of R&D&I funding in Slovakia. If we compare the values of R&D expenditures in individual years in % of GDP (Fig. 2) with the development of OP R&D drawing (Fig. 4), we can see the lowest values of the period under review in both cases. In 2008 and 2009, the OP R&D was still in the process of starting the implementation, with the R&D expenditures at the lowest values of 0.45 and 0.46 respectively % of GDP.

Between 2010 and 2014, the R&D expenditures increased every year, as did the level of spending of OP R&D, while the peak in both indicators was reached in 2015, when the level of the R&D expenditures reached 1.17% of GDP and the OP R&D spent almost EUR 350 million, in both cases the highest values in the period under review. Consequently, the year 2016 saw a significant decline in both indicators, which, according to our analysis, was caused mainly by the fact that no new resources from the Structural Funds were allocated into the area of R&D support, only those from the gradual completion of OP R&D projects.

This analysis of selected indicators confirmed the main hypothesis that the OP R&D was the most beneficial in the area of building, supporting and developing research infrastructure in the SR in all three programming periods.

On the other hand, in 2016, the level of public investments dropped sharply to 0.79%, mainly due to gap of financing from the EU funds between two programming periods. This opens the discussion about sustainability of research infrastructure that was built from the EU funds, and also about the over-reliance of the R&D funding in Slovakia on the foreign sources, especially EU Structural Funds. This can cause significant problems in the near future, as the sources from the EU Structural funds will be limited in the next programming periods, mainly due to concentrating more sources on the new challenges, which the EU is dealing with today such as Brexit or the migration crisis.

Another critical point that needs to be discussed and addressed in near future is the efficiency and proper management of the EU funds distribution within the OP R&I in current programming period. As we have already mentioned in this paper, the amount of financial sources spent in this programming period is very low, as only 9.56% of the allocation of the OP R&I was spent as of 31 December 2018. After the cancelation of some calls in 2017 and some administrative inefficiencies detected in the evaluation process, The Managing Authority nor the Intermediate Body were not able to restart the implementation in an efficient way. Lot of time was lost in 2018 as the criteria for evaluation process were updated, and only a few calls since then were launched anew. In 2017, the automatic decommitment was EUR 27 million and in 2018 it was more that EUR 80 million. On the basis of the average effort and activity of the Managing Authority and Intermediate Body, the 2019 assumption is even more pessimistic. These are devastating losses for the R&D environment in Slovakia, as these resources are irretrievably gone, in accordance with the rules for implementing EU funds. At a time when it is already known that the EU budget will be significantly lower in the next programming period regarding the Structural Funds, these facts prove to be a historically wasted chance of providing the R&D environment with much needed sufficient financial support.

In addition to the inefficient distribution of resources from the EU Structural Funds, another dark event occurred in 2018 in the Slovak Science and Research Environment, where the trivial administrative reasons and the reluctance of competent authorities failed to carry out the process of transformation of the Slovak Academy of Sciences. The Ministry of Education, Science, Research and Sport of the SR rejected the original path of transformation, did not allow the registration of the SAS institutes in the register of the list of public research institutions and encouraged the Slovak Academy of Sciences to transform itself under a different law than it originally had and under substantially different conditions. This, in turn, was unacceptable for the Slovak Academy of Sciences, especially in the context of the belief that it has fulfilled all the conditions of transformation in accordance with the law. The transformation of the Slovak Academy of Sciences was expected to make the lives of scientists easier. Instead, the institution is now struggling in a legal vacuum. The tragic thing about this whole case is that the scientific community (that was supposed to benefit most from the transformation process) became a hostage of political struggles and administrative delays.

7. Conclusion

The cohesion policy of the EU is one its most important and most discussed policies. The main objective of the implementation of the EU Structural Funds is to strengthen economic, social and territorial solidarity in the EU, in particular by promoting growth and employment in regions whose development is lagging behind. Supporting R&D from EU Structural Funds is key to ensuring EU competitiveness and sustainable growth. The main objective of this article was to analyze the impact of the implementation of EU Structural Funds on building, supporting and developing research infrastructure within all three programming periods in the Slovak Republic. We have also set the main hypothesis that the 2007-2013 programming period provided a key contribution to the building, support and development of research infrastructure in the SR.

Based on the findings, we do not consider the implementation of the 2004-2006 programming period to be particularly relevant and beneficial for the analyzed area, in particular on the basis of the amount of funds invested, the number and nature of projects and the fact, that the period was shortened and the R&D support area did not have a comprehensive financial framework in this programming period.

On the other hand, the contribution of projects implemented in the 2007-2013 programming period within the OP R&D can be considered a breakthrough in many aspects for the R&D&I infrastructure. A separate support framework (OP R&D) was established for the area of R&D support, where EUR 1.209 billion was allocated. These funds have been successfully spent by the end of the programming period.

For the first time in the history of the SR, partnerships between individual research institutions have started to form, where top-level research teams have been established for each area - while the lack of crystallization of Slovak science into specific research teams that would be internationally attractive for partnerships equipped with at least basic infrastructure was one of the weakest aspects of the Slovak science and technology system. Better organization of research through the established research teams and more modern infrastructure has made Slovak research institutions, which have become an equal partner for top research institutions abroad, more attractive, and thus has been able to enter international R&D projects.

By setting up priorities and excellent scientific teams, Slovak universities and Slovak Academy of Sciences have been able, through projects, to start the process of building science parks and research centers of national significance. The teams that have implemented centers of excellence in the past formed the basic pillars of science parks and research centers. For the key industry sectors and economy of the SR, the creation of quality partnerships with industry in the form of industrial R&D centers and competence centers was supported through projects. The bottom-up system has identified the strong thematic lines of Slovak science and technology. Supported research centers have clearly demonstrated in which topics in Slovakia the accumulation of critical mass of researchers and infrastructure exists.

In the programming period 2007 - 2013, 14 strategic projects funded under the OP R&D were implemented to establish university science parks and research centers, which were intended to fill the gap in R&D infrastructure. We consider these projects to be the most important and relevant in terms of the analyzed area.

In order to ensure the further functioning of the projects mentioned above and fulfilment of their objectives, it is necessary to provide the financial resources necessary to ensure their sustainability. The OP R&I, which is implemented in the 2014-2020 programming period, has the financing of sustainability of these projects among eligible costs, so therefore it is one of the most obvious possibility how to deal with this problem. But even the OP R&I has limited sources of funding, therefore it will be necessary to ensure the sustainability of projects also from the state budget. Moreover, after analyzing the development of implementation of the OP R&I, we came to the conclusion that, despite its the high potential, this operational program has not yet had a significant impact on the analyzed area in the 2014-2020 programming period, despite the fact, that the implementation has been already under way for the sixth year now and its allocation exceeds EUR 2.2 billion.

Despite the declared importance of R&D&I for the sustainable competitiveness of the SR, the efficiency and performance of the research and innovation potential of the SR remains still one of the biggest challenges. The main problems of Slovak science and research have long been considered to be the low level of funding, the fragmentation of the management system and the unstable and less motivating support for science and research. Ensuring long-term, effective, predictable and stable state funding is essential for the successful development of science and research, as well as creating an environment to increase the share of private resources for R&D in comparison to public resources to a ratio 2:1 while keeping at least the current share of public resources in total R&D expenses.

At the same time, it is essential to reform the R&D&I system, including its management and funding, in order to increase the international competitiveness of the Slovak economy through support for education, research, development and innovation. To ensure employment growth and to improve the quality of life of

citizens, it is essential to create synergies between R&D and industry and to provide conditions for sustainable economic growth.

The fact remains that the EU Structural Funds make up the most significant part of R&D expenditure in Slovakia. Therefore, efforts must be concentrated on the effective redistribution and use of these funds.

At the same time, the efficient use of European Structural and Investment Funds to finance science, research and innovation is not possible without a significant reduction in the administrative burden of their absorption. The administration of the EU Structural Funds must not be a disproportionate burden for scientific teams benefiting from European support. At the same time, it is necessary for the efficient use of these resources in Slovakia in line with EC requirements to set up a sufficient, effective and transparent complementary system of project financing from the state budget and EU framework programs.

To make the most of the unrepeatable support from the EU funds is the historical challenge in order to drive a structural change of the Slovak economy towards growth based on increasing innovation capability and research and innovation excellence to promote sustainable growth in income, employment and standard of living. This should be our common responsibility for the prosperity of the SR and of the future generations.

References

Agentúra Ministerstva školstva SR pre štrukturálne fondy EÚ (2010). Zaostrené na výskum a vývoj. Bratislava: Agentúra Ministerstva školstva, vedy, výskumu a športu SR pre štrukturálne fondy EÚ, 2010. 75 p. ISBN 978-80-970310-1-5.

Agentúra Ministerstva školstva SR pre štrukturálne fondy EÚ (2012). Príklady dobrej praxe. Bratislava: Agentúra Ministerstva školstva, vedy, výskumu a športu SR pre štrukturálne fondy EÚ, 2012. 34 p.

Buček, M. (2006). Úloha poznatkov a vedomostí v regionálnom rozvoji a ich výskum. In Buček, M. et al. eds. Regionálny rozvoj, novšie teoretické koncepcie. Bratislava (Ekonóm).

Čajka, P. (2006). Inovačné centrá v systéme tvorby poznatkov. In: Slovenská politologická revue, 2/2006.

Durkáčová, M. (2010). Efektívny manažment využívania štrukturálnych fondov Európskej únie v ekonomike SR v oblasti výskumu a vývoja. In: Trendy a inovatívne prístupy v podnikových procesoch : 13. medzinárodná vedecká konferencia : 8.12.2010, Košice. - Košice : SjF TUKE, 2010 p. 1-11. - ISBN 978-80-553-0570-7.

European Commission (2012): The 2012 Ageing Report. Economic and budgetary projections for the 27 EU Member States (2010 – 2060).

Gonda, V. (2007). Veda a výskum ako hnací motor znalostnej ekonomiky vo svetle Lisabonskej stratégie. In: Ekonomická revue. Roč. X, 2007, č. 2-3, 16 p. ISSN 1212-3951.

Gros, D., Roth, F. (2012). "The Europe 2020 Strategy: Can it maintain the EU's competitiveness in the world?" Centre for European Policy Studies Working Paper No. 7260. Accessed April 25 2014. Available at: https://ideas.repec.org/p/eps/cepswp/7260.html

Kačírková, M. (2016). Univerzitné vedecké parky a výskumné centrá ako základňa inovácií na Slovensku. Ekonomický ústav SAV, Bratislava 2016. 37 s. ISSN 1337-5598.

Morvay, K. et al. (2017): Economic development of Slovakia in 2016 and Outlook up to 2018, Institute of Economic research of Slovak academy of sciences, Bratislava 2017, ISBN 978-80-7144-278-3.

Šikula, M. et al. (2010): Stratégia rozvoja slovenskej spoločnosti. Bratislava, VEDA. 696 p. ISBN 978-80-224-1151-6.

Spišáková, E. (2013). Influence of the economic crisis on the fulfillment of the target of Strategy Europe 2020 in the area of research and development. In Financial aspects of recent trends in the global economy. Vol. 1. Craiova: ASERS Publishing, 2013. 34-53 p. ISBN 978-606-93129-6-4.

Vokoun, J. (2016). Firemné investície ako predpoklad rozvoja domáceho inovačného potenciálu. Medzinárodná vedecká konferencia „Investovanie v Európe – súčasný stav a perspektívy". Univerzita Mateja Bela Banská Bystrica, Ekonomická fakulta. Banská Bystrica, 8. november 2016.

Websites:

European Commission (2018). Europe 2020 Strategy. [online] Available at: https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-economic-governance-monitoring-prevention-correction/european-semester/framework/europe-2020-strategy_en

European Union (2018). Financial framework 2007 – 2013. [online] Available at: http://ec.europa.eu/budget/figures/fin_fwk0713/fwk0713_en.cfm#cf07_13

Eurostat (2017). Research and development expenditure in Slovakia % of GDP. [online] Available at: https://ec.europa.eu/eurostat/tgm/table.do?tab=table&plugin=1&language=en&pcode=tsc000

Central Coordination Body (2007). National strategic reference frame 2007 – 2013. [online] Available at: http://www.nsrr.sk/en/narodny-strategicky-referencny-ramec-2007-2013/

Central Coordination Body (2018). Drawing of National strategic reference frame 2007 – 2013 as to 31.12.2016. [online] Available at: http://www.nsrr.sk/cerpanie/

Central Coordination Body (2018). Implemention of the ESI Funds as to 31.12.2018. [online] Available at: http://www.partnerskadohoda.gov.sk/implementacia-esif-k-31122018/

The Ministry of Education, Science, Research and Sport of the Slovak Republic (2008). Proposal of long-term intention of state science and technical policy until 2015. [online] Available at: http://www.asfeu.sk/uploads/media/Dlhodoby_zamer_SVTP_do_roku_2015.pdf

The Ministry of Education, Science, Research and Sport of the Slovak Republic (2013). The Smart Specialization Strategy. [online] Available at: https://www.opvai.sk/media/57255/through-knowledge-towards-prosperity-research-and-innovation-strategy-for-smart-specialisation-of-the-slovak-republic.pdf

The Ministry of Education, Science, Research and Sport of the Slovak Republic (2018). Operational Program Research and Innovations. [online] Available at: https://www.opvai.sk/o-nas/op-vyskum-inovacie-programovy-dokument/

The Ministry of finance of the Slovak republic (2018). Programming period 2007 - 2013. [online] Available at: http://www.finance.gov.sk/Default.aspx?CatID=6231

The Ministry of economy of the Slovak republic (2007). Innovation strategy of the SR for 2007 -2013 [online] Available at: http://www.siea.sk/oldweb/inovacie/subory/inovacna_strategia.pdf

The Slovak Government Council for Science, Technology and Innovation (2016). SK Roadmap 2016. [online] Available at:

https://www.vedatechnika.sk/SK/VedaATechnikaVSR/Stranky/Narodny-plan-vyuzitia-a-rozv-vysk-infrastrukt-SKRoadmap.aspx

The Research Agency (2018). Operational Program Research and Development. [online] Available at: http://www.asfeu.sk/operacny-program-vyskum-a-vyvoj/op-vyskum-a-vyvoj/