ANALYSIS OF GROSS DOMESTIC EXPENDITURES ON RESEARCH AND DEVELOPMENT IN SOUTH EAST EUROPEAN COUNTRIES

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Abstract: *Research and development activities are one of the main sources of competitive advantage in the most developed countries. Research and development include innovative activities in developing new and improving existing services or products. This paper focuses on the analysis of gross domestic research and development expenditures (GERD) in South East European (SEE) countries. It will include a comparison of GERD by sources of funding and by type of research and development. Additionally, the correlation between GERD and global competitiveness of SEE countries will be conducted.*

Keywords: *research and development, expenditures, competitiveness*

1. INTRODUCTION

Research and development activities are one of the necessary factors for achieving benefits and overall development of the country. Within the past decades, the manufacturing-based industrial society that emerged within the nineteenth century has been transformed into an information economy.

The main objective of this paper is an implementation of analysis of gross domestic research and development expenditures (GERD) and the correlation between GERD and global competitiveness in South East European countries: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, FYR of Macedonia, Greece, Montenegro, Romania, Serbia and Turkey.

The structure of this paper consists of 6 main parts: introduction, literature review, research and development strategies in South East European countries, methodology, results and conclusion.

2. LITERATURE REVIEW

The introduction of research and development rivalry started with the models of Romer (1987), Romer (1990), Aghion and Howitt (1992), Grossman and Helpman (1991) and other comparable works (Barro and Sala-I-Martin, 2004). In 1992, Aghion and Howitt built up a model of endogenous development by including the job of research and development in financial development. This model utilized the possibility of inventive devastation. It expect that the individual research can likewise influence the entire economy. The model inferred

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balance through forward-looking contrast condition. It implies that the pace of research in a period relies upon present research and on the profitability of research. [1]

Research and development for all countries is one of the more important segments for achieving competitiveness advantages and overall development of countries. In the past several decades the manufacturing-based industrial society that emerged in the nineteenth century has been transformed into an informational society, and a knowledge economy. As the Nobel Laureate Ken Arrow noted, "The central economic fact about the processes of invention and research is that they are devoted to the production of information". The generation of information requires research; therefore, research is going to be one of the most important jobs in the society of the future. Just as farmers in preindustrial society were central players, particularly in periods of famine, so the researchers will be the central players in the future, especially in the advanced industrialized economies.[2]

Authors Rajnoha and Dobrovic state that actual business environment has changed dramatically and depends especially on the performance in generating and utilizing new knowledge, information systems, innovations and management techniques and tools for creating the higher business performance. Exploring the competitiveness-enhancing determinants has occupied the economists' minds for hundreds of years. Starting with Adam Smith's theories focused on specialization to neoclassical economists' underlying the need to invest in physical capital and infrastructure, up to the current interest in areas such as education, professional training, technological progress, macroeconomic stability, market efficiency, etc emphasize that market economy is a competitive economy, thus competition is a crucial part of economic activity.[3]

Measuring and increasing global competitiveness is a complex and difficult process. In recent decades, economic science, as well as practices, have been paying attention to innovation, considered to be the main driver for countries' economic competitiveness and growth. As reported by Hunady et al. (2017), innovation potential still differs significantly not only among EU regions, and R&D expenditure seems to be the key factor determining the innovation potential and performance of a region. According to Szarowska (2017), R&D is fundamental for the knowledge-based economies' competitiveness, and support of R&D and innovation is also a political measure. In line with the Lisbon strategy and Europe 2020 targets, investment in European R&D should be increased to 3% of GDP, but this target has not yet been reached. From this point of view, Habanik et al. (2016) emphasize that in the absence of significant changes in legislation, competences and financial incentives that promote research and development investments and innovations in industry, technologies, and services, the regions will fail to attract capital to support R&D and innovation potential. In this regard, they will also fail in shaping a new structure of the economy based on long-term competitiveness.[4].

3. RESEARCH AND DEVELOPMENT STRATEGIES IN SOUTH EAST EUROPEAN COUNTRIES

Since this research has been focused on South East European (SEE) countries, strategic objectives regarding R&D activities from these countries, will be presented in the following text.

In Albania The National Strategic Program aims to: develop innovation in key sectors of the Albanian Economy – growing awareness to the enterprises on innovation and technology development needs; initiate, import, modify and diffuse new technologies in enterprises; increase the capacity of business supporting organisations to assist in the innovation of

enterprises; assist directly with technical information; assist enterprises to gain external funding for innovation activities; enable the creation of new innovative firms [5]

The significance of the development of science and technology (S&T) in Bosnia and Herzegovina is emphasized at all international forums, especially after the adoption of the document "EU-Balkans countries, Action plan for S&T" 2003, as well as during all meetings and conferences involving policy makers for S&T in the countries of West Balkans and EU countries. In accordance with the aforesaid, Bosnia and Herzegovina acknowledged the development of science and technology as one of its priorities. A renewed establishment of an efficient system of research and technological development of Bosnia and Herzegovina (B&H) includes development of a Strategy with full support of all bodies involved in its development, specifically the decision-makers at all levels of authority in its implementation phase, because this it is the only possible way to develop the „triangle" of the prosperous future of a country: education - science – economy, with positive participation of the authorities (politics) as a catalyst.

The goals of the Strategy for the development of science in BiH are:
- To ensure a leading role of science and technology as factors of a long-term development of a country through the consensus of all decision-makers in such a way that the development of science represents a general interest;
- Increase funds of the public and private sector in B&H for the field of science and technology at the basis of long-term and short-term defined priorities and plans; as well as ensure continuous support to innovations, transfer of technologies and commercialization and application of scientific achievements;
- Follow-up the development of science and technology and its effects to other areas of society based on internationally recognized statistical standards;
- More active participation of B&H researchers and institutions in the European scientific research network and European Research area (ERA);
- Develop a new system of higher education and enable it to perform competent scientific research work, with the aim to ensure new generation of scientists and professional development of existing scientific and research personnel;
- Structural changes in the scientific research systems, with the emphasis on cooperative and joint research of universities, scientific-research institutes and industry; that is, ensure a stronger connection of science and economy with the aim of achieving development goals;
- Ensure access to electronic scientific databases, connecting library systems, support to strengthening local scientific magazines, establishing databases of scientists and scientific institutions;
- Development of research infrastructure by international standards;
- Re-investing into industrial research in a certain number of sectors.

Therefore, the goals of the Strategy for the development of science in B&H are the development and building of Bosnia and Herzegovina as a new, modern society, known as „the society of knowledge", where knowledge is the key creative force in the personal, economic, social, cultural and financial progress.[6]

Science and innovation are key factors of competitiveness and sustainable development. The main preconditions for the creation of an innovative society of knowledge are the excellence and relevance of scientific and research results. Excellence is a measure of quality and international visibility of scientific and research results, and the relevance represents the impact

of the scientific and research results on the economy and society. The Strategy on Scientific and Technological Development of the Republic of Serbia for the period 2016 – 2020 – Research for Innovation (hereinafter: the Strategy) is a document which sets out measures and programs for the promotion of excellence in science and targeted research for the development of economy and society as a whole, in the next five years. Within five years, science in the Republic of Serbia will be based on a competitive system that supports excellence in science and its relevance to economic development, competitiveness of the Serbian Economy, and development of society as a whole.[7]

Romania must also fulfill a specific ex-ante conditionality as far as the relation between its R&D and its economic competitiveness strategies is concerned. The strategic mechanism should be directly linked to the process of monitoring and assessment of the implementation of the National Strategy for R&D 2014-2020. Objectives for the increase of effectiveness of the national Romanian research system are:

- Increase the research and development (R&D) expenditures – Indicator: 1% of GDP for public R&D expenditure and 1% of GDP for private R&D expenditure, by 2020,
- Improve the efficiency of R&D expenditure by prioritization and competition by: Improving the governance of the national research system – Indicator: operational mechanism for decision and monitoring.
- Increase the share of project based funding – Indicator: the share of project based funding in total public R&D funding (target 50%). Increasing the competitive institutional funding- Indicator: the share of competitive institutional funding in total institutional funding (target 70%).
- Increase private R&D expenditure. Promoting regulations on fiscal incentives- Indicator: number of initiatives or adopted documents.
- Enhancing Romanian participation in European research programmes and initiatives. – Indicator: number of Romanian participations to European research programmes and initiatives.[8]

Turkey's key commitments, reflecting medium-term objectives, are broadly in line with those provided in previous summits. In this respect, with the Law 6676 issued in February of 2016, a wide range of incentives were implemented by government in order to (i) raise the number of R&D centers, (ii) provide funding for fee subsidies of the R&D staff, (iii) improve the Technology Development Zones Law and (iv) decrease the tax burden on R&D projects. Besides these, Turkey has endeavored to establish thematic technology development zones in strategically significant sectors and offered a set of incentives to these pioneer sectors to boost their R&D capacity and innovation in context of the Law 6676. By the end of 2015, the ratio of general R&D expenditures to GDP increased to 1.06 percent from 1.01 percent in 2014.[9]

Without scientific-research and development activity, in areas vital for Montenegro, there can be no successful and timely transfer of knowledge from the world treasury, nor of the newly acquired domestic knowledge to support economic development and competitiveness. Recognition of positive aspirations, scientific achievements and their application, first of all in the country and the region, and then globally as well, is of utmost importance. Familiarization with them through established communication and good relations enables positioning of proper achievements and needs through development of positive competitive spirit in the creation of conditions for achieving results useful to oneself and to others, avoiding of mistakes made by others and unnecessary investment in the affairs they have already completed. Comprehension of the knowledge market and its application in closer and wider European environment would ensure to new staff a feeling of exit from anonymity, but also a feeling of increased openness

and perspective for wider application of new knowledge. Competitiveness is a base for a higher value of products or services, and it is conditioned by the quality and the quantity of knew knowledge. In order to reach this kind of results, it is important to have a two way dialogue and exchange of information between the scientific-research community and the economy. In synergy, all this leads to a rapid increase of employment and growth of GDP. [10]

In the EU, as in most developed economies, the accepted ratio of public/private investment in R&D is 1/2. In line with that, and with the stated goal of Bulgaria to reach 1.5% R&D intensity by 2020, it will be the ambition of the Ministry of Education and Science to expand the public investment in research from 0.25% currently to (0.45%) of GDP in 2020. Moreover, a new goal of 2.0% R&D intensity by 2025, with which Bulgaria would reach the current EU average R&D intensity, would require a further rise in the public R&D investment to 0.67% in the longer term.[11].

Greece will strive to achieve the national GERD/GDP target ratio of 1.2% by 2020 and to increase private sector contribution to 0.38%. Particular attention will be paid to promoting activities/actions to leverage R&D by the private sector and to increase the number of skilled staff in companies.[12]

The National R&D Programme 2012-2016 aims at facilitating the transformation of Macedonia into a knowledge-based society. The National Programme defines the objectives, content and scope of scientific research. In particular, it covers the coordination, implementation and financing of scientific and research activities achievements, international cooperation and synergies with the business sector. Gross expenditures od R&D are expected to grow significantly, reaching 1% of GDP in 5 years and 1,8% of GDP by 2020. The business sector is expected to account for 50% of gross R&D expenditures.[13]

Since 2009, following the global economic and financial crisis, the level of investment in R&D decreased from 1.05 to 0.75% of GDP in 2012, with a slight increase to 0.81% in 2013. Croatia is the only new member state from Central and Eastern Europe whose GERD/GDP is lower in 2013 when compared to 2002. This level of expenditure has stagnated since 2010 and it is well below the EU average of 2.02% (2013). In absolute terms, Croatia spent about 354.7 million EUR in 2013 on R&D (Eurostat, 2014). From total GERD amount, 50,1% comes from the business enterprise expenditure on R&D (BERD), in comparison with the EU average of 63.8%. To improve the situation, Croatia has recently created a pipeline of R&D infrastructural projects in order to prepare their implementation through Structural Funds for the period 2014-2020.[14]

4. METHODOLOGY

This research has been focused on the analysis of gross domestic research and development expenditures (GERD) in South East European (SEE) countries. Countries included in the analysis are:
- Albania,
- Bosnia and Herzegovina,
- Bulgaria,
- Croatia,
- FYR of Macedonia,
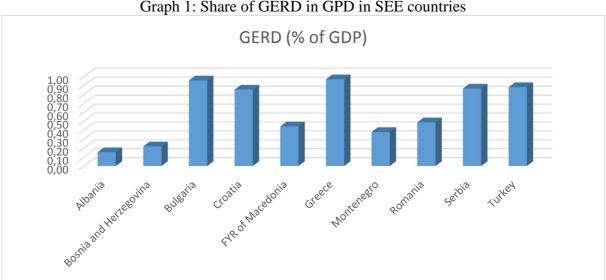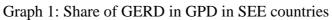- Greece,
- Montenegro,
- Romania,

- Serbia and,
- Turkey.

The analysis includes a comparison of GERD by sources of funding and by type of research and development. Sources of funding include industry, government, international sources and other national funding. On the other side, types of research included basic research, applied research and experimental development. Additionally, the correlation analysis between GERD and global competitiveness of SEE countries was conducted. Data from the Innovation Policy Platform statistical tool [15] and the Global Competitiveness Report for 2017/2018 [16] were used.
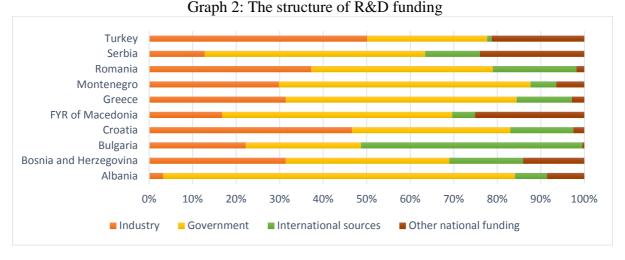
5. RESULTS

Share of gross expenditures for research and development in Gross Domestic Product is used as one of the main indicators in this analysis. It is used, because it eliminates size of the economy as a factor that influences an amount of expenditures for research and development (R&D) activities. This indicator gives more comparison possibilities than the total amount of GERD. Bulgaria (0,96%), Turkey (0,88%) and Serbia (0,87%) achieve highest rates of GERD as a percentage of GDP.

On the other side, the share of GERD in GDP in SEE countries is mostly lower than in other European countries. The fact that 5 out of 10 SEE countries are in a bottom quartile, says enough about the awareness of R&D importance in these and other SEE countries. In addition, best ranked SEE country, Bulgaria, is on 29th place out of 47 European countries.
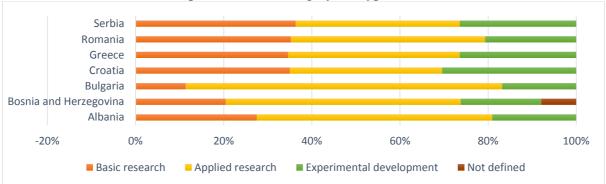
Graph 1: Share of GERD in GPD in SEE countries

Further analysis of the structure of financing sources of R&D activities showed that there are some similarities between analyzed countries. It can be seen that in 7 out of 10 countries, government funding is the biggest financial source of R&D activities. Albania achieves the highest rates with 80,81% of government funding of all fundings of R&D activities. On the other side, Bulgaria, as the best ranked SEE country, achieves 50,88% share of international sources of total financial sources for R&D. This is a very good example of the attraction of international investments in R&D activities. Also, Croatia and Turkey achieve the most of their R&D funding through non-governmental sources. These countries managed to attract mostly industry sources of funding.

Graph 2: The structure of R&D funding

Regarding types of R&D, data for only 7 out of 10 countries were available. All countries, except Croatia, achieve the biggest share of applied research. Croatia and Serbia achieve the most dispersed funding structure by the type of R&D activities. These countries, together with Greece (26,45%), invest more than other countries in experimental research (Serbia 26,44% and Croatia 34,97%).

Graph 3: R&D funding by the type of R&D

The correlation between GERD and global competitiveness of SEE countries is analyzed in order to measure possible effects of R&D activities on the economy. A percent of GERD in GDP and Global Competitiveness Score have been used as indicators in this analysis. The calculation showed that the correlation coefficient equals 0,367 and that determination coefficient equals 0,135. It can be said that there is a moderate positive correlation between expenditures for R&D activities and competitiveness of analyzed countries. Further calculation of Spearman's rank correlation coefficient, which is based on rankings of these countries on the world level, showed that the association between the two variables would not be considered statistically significant. The biggest disadvantage of this analysis is a small number of analyzed countries, so this conclusion should not be used for all other countries in the world. In addition, the influence of other factors on the competitiveness of SEE countries is 86,33%. This shows that many other factors affect further commercial exploitation of the results of R&D activities.

Graph 4: The correlation between GERD and GCI

6. CONCLUSION

Research and development activities present one of the fundamental preconditions for higher growth and competitiveness of the country. All South East European countries adopted strategic documents with clear research and development focused objectives. On the other side, research and development needs to be supported with other strategies and their practical implementation. As descriptive statistics showed, it is necessary to think about a lot of other factors that influence R&D effectiveness – like institutional framework, range of patents, doing business, kind of R&Ds, sectors of performance, quality of human capital etc.

As already presented the results in paper,the correlation between GERD and global competitiveness of SEE countries is analyzed in order to measure possible effects of R&D activities on the economy. The calculation showed that there is a moderate positive correlation between expenditures for R&D activities and competitiveness of analyzed countries. Further calculation of Spearman's rank correlation coefficient, which is based on rankings of these countries on the world level, showed that the association between the two variables would not be considered statistically significant.

This analysis can be used as a base for further research of innovation process in SEE countries. In that way, other factors that show connection between higher leveles of innovativeness and competitiveness could be explored. SEE countries should use a higher level of R&D as an orientation during creation and implementation of institutional and public finance strategies.

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