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INVESTMENT IN RESEARCH AND DEVELOPMENT IN THE PROCESS OF ACCESSION OF MACEDONIA IN THE EUROPEAN UNION

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Abstract

High unemployment rates, low employment rates, low levels of GDP per capita and still higher orientation of the activities of primary and secondary sector characterize Macedonia and other Western Balkan countries. In such circumstances, as a basic long-term economic and strategic goal is full membership in the EU, which is a complex and time-consuming process that requires the creation of foundations for the implementation of comprehensive structural reforms. It is identified the importance of investing in research and development and general knowledge-based activities, which represent a fundamental contemporary economic resource. The goal of the conducted research is to analyze the economic situation and the level of investment in research and development in Macedonia and to propose appropriate measures for their improvement. The purpose of the research is to highlight the importance of investing in research and development to achieve economic growth and the achievement of structural reforms in Macedonia, as a function of its adjustment to the EU economy. The research is based on the secondary sources, ie, statistical bases of the EU (Eurostat), AMECO and the World Bank as well as on data from the national statistical base and national strategic documents.

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1. INTRODUCTION

The Western Balkan countries[8] including Macedonia experienced severe consequences of war and political turmoil in the previous period. Thus, it was very difficult to face with the economic and social transition, resulting in unfavorable economic and social conditions. High unemployment, low levels of GDP per capita and unfavorable educational structure characterize the economic systems of these countries, which resulted in large numbers of the poor and low standard of living. In order to improve such economic situation, it is necessary to engage all factors of social, political and economic life in preparation for development strategies and national strategic plans. Overcoming these problems involves the assistance of European and international institutions, particularly in education, research and acquiring new knowledge. As a key, the long-term goal of the Western Balkans, it is to overcome the unfavorable economic situation and achieve competitiveness at the international level and full EU membership. The European Union has developed policies that support the gradual integration of the Western Balkans.

Generally, according to Article 49 of the Treaty on the Functioning of the European Union (TFEU), "every European country that respects the principles set out in Article 2 of the same Treaty (principles of human dignity, freedom and equality, democracy and rule of law, etc.) and which is ready to promote it, may become a member of the Union". On the other hand, under the 2009 Lisbon Treaty, Article 50 of the UFEU[9] was introduced, according to which each member country may request the resignation from full membership in the EU. Furthermore, Article 50 of the UFEU implies exit negotiations in respect of the commitments previously assumed. In addition, if no agreement is reached, the Membership Agreement expires two years after the formal request to leave.

The accession of new EU members to the EU is determined by the two basic criteria[10] of Copenhagen criteria from 1993 and the criterion from Madrid in 1995 (Kandžija and Cvečić, 2010). The Copenhagen criteria include the political, legal and economic criterion. Consequently, the political criterion implies *"the existence of stable institutions that will enable the implementation of democracy, rule of law, protection of minority rights and human rights"*. Furthermore, the economic criterion implies *"the existence of an efficient market economy ready to take over with growing competition"*. In this case, Sauron (1997) determines the fundamental characteristics that determine the existence of an efficient market economy: 1. the formation of supply and demand through free competition, 2. the absence of significant barriers to entry and exit from the market, 3. the existence of a consensus on economic policy, 4. eligibility of the private property system and agreement; 5. macroeconomic stability in accordance with the Maastricht criteria; and 6. developing a financial system that directs savings towards productive investments. Finally, the legal criterion "implies an obligation to accept the EU acquis in the candidate countries". The Madrid or administrative criterion represents a complement to the Copenhagen criteria and prescribes the existence and adaptation of the administrative structures for the purpose of successful adaptation to integration.

Faced with the potential accession of Western Balkan countries, in 2003, the EU defined "additional" criteria for the countries of the Western Balkans in order to stabilize this area. These criteria include cooperation

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8) As defined by the European Commission in 2003, a group of Western Balkan countries includes all countries of the former Yugoslavia, with the exception of Slovenia and the addition of Albania. Upon declaration of independence, this group of countries involved Montenegro in 2006 and Kosovo in 2008. For the purpose of this research, the Republic of Croatia has been excluded from this group of countries since it became the EU member state in 2013. Kosovo has also been excluded from analysis because it is determinate that in this country does not exsist structured data about investments to research and development. For the purpose of this research, the Republic of Croatia has been excluded from this group of countries since it became the EU member state in 2013.

9) This article was first activated by the United Kingdom, whose citizens voted to leave the EU in a referendum in 2016. Then the process known as BREXIT began.

10) Of course, countries must first "possess" a geographic criterion, which states that in this case it has to be a country that is mostly located on the European continent.

with the International Criminal Tribunal in Hague, taking care of refugee return and protection of minorities, insurance of the media rights and judicial reform, and encouraging regional cooperation and development and good neighborly relations (Kandžija, Cvečić, 2010).

The EU Strategy for the countries of South East Europe and the Western Balkan countries is defined through the Stabilization and Association Agreement (SAA), the encouraging of economic co-operation, financial assistance, political dialogue, and encouragement of cooperation and assistance in democratization and the protection of fundamental rights. The Stabilization and Association Agreement represents a new generation of agreements aimed at ensuring cooperation between the EU and the relevant groups of countries, aligning legislation, developing economic relations and promoting regional cooperation within the stabilization and association process. The agreement also contains an evolutionary clause granting the country the status of a potential candidate and thereby in some way "guaranteeing" future EU membership. Before the agreement comes into effect, the countries sign an Interim Agreement for regulating trade issues.

Macedonia was the first country in the region that signed SSP in 2000 which entered into force in 2004. At the end of 2005, Macedonia got official candidate status but there was no defined date for the start of the official negotiation. In 2008 the accession partnership was defined and in 2009 the European Commission proposed the start of official negotiations. The official negotiations have been offset by initiatives of the Council of Ministers because of disagreement over the name of the state, complex relations with Bulgaria about historical and ethnic issues and national issues that include the political integration of the Albanian population. Further progress of Macedonia towards European integration will be largely determined by solving the national problems and the implementation of political reforms demanded by the EU.

The main goal of the research conducted in this paper is to provide an overview of the theoretical aspects of investment in research and development as a factor of economic growth, analyze the economic situation in Macedonia, analyze the state of investment in research and development in Macedonia and ultimately to propose the measures for improvement of activities of research and development in Macedonia. The purpose of the research conducted in this paper is to point out its importance for achieving economic growth in Macedonia by reviewing theoretical assumptions and analysis of investments in research and development in order to adapt the EU economy.

By examining the literature there was a lack of relevant scientific papers on the effects and importance of investment in R & D as a factor of economic growth and convergence in the Western Balkan countries, from which comes the basic motivation and scientific justification for the implementation of this research. Also, during the research, authors faced the lack of an unstructured relevant data needed to evaluate the investment in research and development in Macedonia. Such a situation is also present in other Western Balkan countries. This group of countries, including Macedonia, represents *the future, but also the challenge and reality* of the EU, and it is, therefore, necessary to direct additional effort to improve their economic, social and political situation.

The paper is structured into seven interrelated chapters. After introductory considerations, the research methodology and the key variables and data sources are discussed in detail. The research has continued with the assessment of the economic situation in Macedonia, reviewing the current research on the importance of investing in research and development in the process of achieving economic growth and convergence. According to the scientifically based conclusions, a package of measures has been proposed to improve the position of Macedonia in the integration processes and to accelerate its adaptation to the EU economy. The paper ends with the conclusion summarizing the most important conclusions that have been reached during the research.

2. RESEARCH METHODOLOGY

In the research, a descriptive analysis of the economic situation and investment in research and development in Macedonia was conducted.

The following key indicators of the economic situation were used: GDP per capita (current US$), GDP growth rate (%), added value of agriculture, industry and services (% of GDP), employment in agriculture, industry and services (% of total employment rate), unemployment rate (% of workforce), current account deficit (% of GDP), public debt level (% of GDP) and level of foreign investment (% of GDP).

Investments in R & D are analyzed on the basis of the following key data: investment in R & D (% of GDP), investment in research and development undertaken by the business sector, the public sector, the higher education sector and the private non-profit sector (% of total investments (%),the share of the population aged 18-34 participating in lifelong learning programs (%), public investment in education (% of GDP), share of population aged 30-34 years with completed tertiary education (%), number of new doctors of science on 1000 inhabitants, number of employees in science and technology, share of high technology products in total exports (%).

A significant problem in this area was the absence or the unsystematisation of a large number of investment in research and development key indicators, which were not available in any of the relevant statistical bases. Such a situation implies the need for significant efforts to create a relevant national statistical base, which would contribute to the quality of the research in this area

The analysis of the economic situation and investment in research and development has, according to the availability of data, covered the period from 2000 to 2016.

The research in this paper is based on secondary sources, ie, statistical bases of the EU (Eurostat), AMECO and the World Bank as well as data from the national statistical base and national strategic documents.

Following the descriptive analyzes and the proposed key measures, a projection of investment in research and development in Macedonia in the period 2015-2025 was carried out. The projection was carried out using the exponential smoothing method, which is commonly used in time series. Using this method, the forecast for the period is obtained as a weighted average of the actual and projected time series value in the period t. To the actual value of the time series in the period joins the weight w (smoothing constant), which takes the value between 0 and 1, while the weight is added to prognosis t. The higher the value of the parameter, the greater the weight added to the previous period (Winters, 1960).

The Holt-Winters method uses triple smoothing and has three smoothing constants:

1) the constant used for each exponential smoothing (overall smoothing)

2) the constant used to determine the trend the trend of the movement of the value (trend smoothing)

3) the constant used to determine periodicity of the value (seasonal smoothing)

Prediction is calculated based on the following formulas:

$$S_t = \alpha\, y_t / I_{t-L} + (1- \alpha)(S_{t-1} + b_{t-1}) \tag{1}$$

$$b_t = y(S_t - S_{t-1}) + (1-y) b_{t-1} \tag{2}$$

$$I_t = \beta\, y_t / S_t + (1- \beta) I_{t-L} \tag{3}$$

$$F_{t+m} = (S_t + m b_t) I_{t-L+m} \tag{4}$$

where are:

y = observed values

S = smoothened values

B = trend factor of value

I = the periodicity index of the value

F = prediction for m period in advance

T = index indicating the time period

3. ANALYSIS OF THE ECONOMIC SITUATION IN MACEDONIA

The GDP per capita level in Macedonia was constantly increasing in the analyzed period, and this was particularly obvious in the period 2001-2008. After that, particularly because of the severe consequences of the global economic crisis, the Macedonian economy is slowing down, and it is also visible at the levels of GDP per capita, which by 2014 stagnate or fall. The GDP per capita amounted to USD 5237.17 in 2016, which represents an increase compared to 2015 (Chart 1).

Chart 1:
Evolution of GDP per capita in Macedonia in the period 2000 - 2016 (current US$)
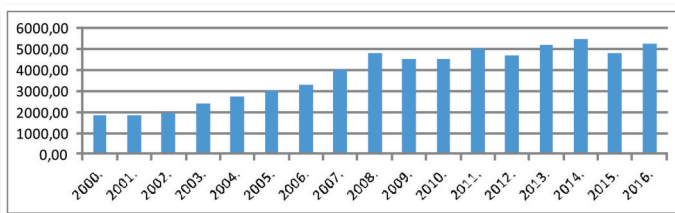
Source: developed by the authors, based on the World Bank (1), 2017

In the observed period, the Macedonian economy grew at an average of 2.9% per year, with negative growth rates in 2001 and 2009 and 2012 (Chart 2). Compared to the EU average over the same period (average growth rate of 1, 48% per year), it is clear that the Macedonian economy is growing faster, confirming the basic convergence assumption that "less developed countries are growing faster than the more developed ones."

Chart 2:
GDP growth rates in Macedonia in the period 2000 - 2016 (%)
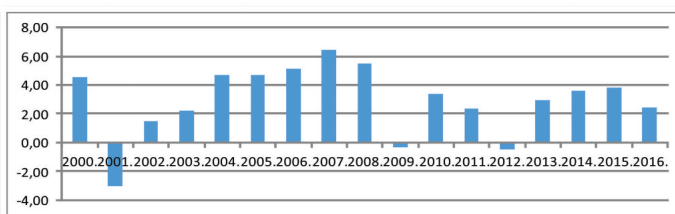
Source: developed by the authors, based on the World Bank (2), 2017

The available data suggest that in the analyzed period Macedonia decreased development lags for the EU average and, given the value of GDP per capita in 2016, was at 36% of the EU average, which represents

an improvement over 2005, when the Macedonian economy was at 28% of the EU average. However, this situation indicates the still great lags that represent a challenge in the process of joining the EU.

Furthermore, the state of the Macedonian economy has been assessed on the basis of the contribution of the three key economic sectors (primary, secondary and tertiary) to the added value of GDP and total employment.

The data from Table 1 indicate the certain changes in the structure of the Macedonian economy. It is evident that Macedonia over the observed period has reduced the share of the agricultural sector and the service sector and increased the share of the industrial sector.

Table 1: Added Value of agriculture, industry and services in GDP in Macedonia 2000-2016 (%)

Year	Agriculture	Industry	Services
2000.	11,98	25,39	62,63
2001.	11,50	24,30	64,19
2002.	12,34	23,50	64,16
2003.	13,35	26,03	60,62
2004.	13,31	24,24	62,44
2005.	11,34	23,71	64,95
2006.	10,34	24,92	64,74
2007.	10,36	23,88	65,76
2008.	13,29	22,69	64,02
2009.	12,00	21,95	66,05
2010.	11,73	24,40	63,87
2011.	10,87	25,10	64,04
2012.	10,53	24,37	65,10
2013.	11,52	25,45	63,03
2014.	11,72	26,29	61,99
2015.	11,41	26,62	61,98
2016.	9,89	29,71	60,40
EU	1,52	25,43	74,07

Sources: developed by the authors, based on the World Bank (3), World Bank (4), World Bank (5), 2017

Agricultural activities in Macedonia amount to 9.89% of GDP, which is 6.5 times more than the EU average. Furthermore, since 2012, Macedonia has steadily increased the share of the secondary (industrial sector) in GDP, which is above the EU average. However, the problem of such a structure arises from the orientation of the industry to the traditional sectors, which can not represent the strong foundation of economic growth and achievement of convergence in modern conditions. In that regard, this indicator points to the necessity of orientation to modern growth engines (investment in research and development and their products), and the emphasis is put on further research in this paper. Furthermore, data also point to a reduction in the share of the service sector, which is also in contradiction with modern economic trends. Namely, the share of 60.40% of GDP generated by service activities is considerably lower than the EU average.

In order to gain further knowledge of the economic situation in Macedonia, the employment trends in certain sectors for the period 2000-2016 are analyzed below (Table 2).

Table 2: Employment in agriculture, industry and services in Macedonia for the period 2000-2016 (%)

| Year	Agriculture	Industry	Services
2000.	17,60	30,40	51,90
2001.	19,40	29,40	51,20
2002.	19,50	29,50	51,00
2003.	18,60	30,10	51,30
2004.	17,40	30,00	52,60
2005.	18,10	29,40	52,40
2006.	18,10	30,00	52,00
2007.	17,40	29,80	52,80
2008.	18,30	29,50	52,20
2009.	18,00	29,10	52,80
2010.	18,00	29,40	52,70
2011.	17,50	30,00	52,50
2012.	17,10	30,00	52,90
2013.	17,60	30,00	52,40
2014.	16,80	30,10	53,20
2015.	16,40	29,60	54,00
2016.	16,30	29,50	54,20
EU	4,4	23,75	71,55

Source: developed by the authors, based on the World Bank (6), World Bank (7), World Bank (8), 2017

The data from the Table indicate that Macedonia has reduced the share of agricultural employees in the observed period. However, the level of 16.3% of the employed population in the agricultural sector is still 4 times higher than the EU average. Also, minor reductions have been achieved in the secondary sector, which employs 29.5% of the population, making Macedonia still above the EU average. In the service sector, employment growth has been achieved. However, the value of 54.2% is almost for 18% percentage points lower than the EU average. All this points to the necessity of further education of the population and the improvement of the workforce, which should be a key tool for achieving economic growth, convergence and adaptation of business conditions to the EU Internal Market.

The unfavorable situation in the Macedonian economy is particularly evident from the unemployment data (Chart 3).

Chart 3:

Movement of unemployment rate in Macedonia in the period 2000-2016 (% of workforce)
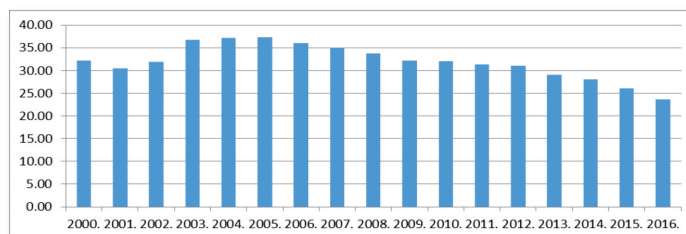
Source: developed by the authors, based on the World Bank (9), 2017

Although relative reductions have been achieved in the period since 2005, Macedonia still has a very high unemployment rate, ie 24.4% in 2016, almost three times higher than the EU average. Such a situation is the basis for creating social unrest, poverty and social exclusion, which ultimately represents a long-term problem and an obstacle to EU involvement and adaptation to modern economic conditions. According to Eurostat (2), 24.8% of the population in Macedonia is at risk of poverty and social exclusion. Also, the minimum wage in Macedonia amounts to EUR 213.7 (Eurostat (3), 2017).

As well as other countries in the region, Macedonia is an import-oriented country in terms of foreign trade, which during the entire observed period achieved a deficit of the balance of payments, which in 2016 was at the level of 2.74% of GDP (Chart 4).

Chart 4:

Current account deficite in Macedonia in period 2000-2016 (% of GDP)
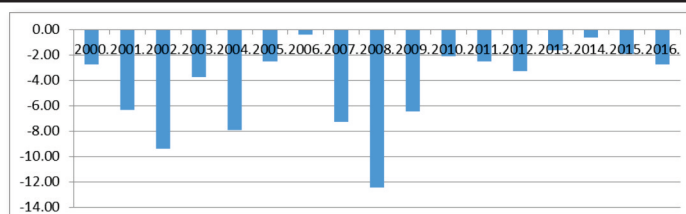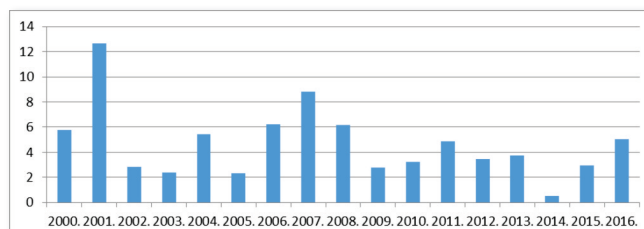

Source: developed by the authors, based on the World Bank (10), 2017

Analyzing the import structure, it is clear that Macedonia imports platinum, oil and automobile to a large extent, while exports are dominated by the reaction and catalytic products, centrifuges and insulated wire. Furthermore, Macedonia exports most to Germany, Serbia and Bulgaria, while most of the exports are exported from Germany, the United Kingdom and Serbia (The Observatory of Economic Complexity, 2017). The foreign trade position of Macedonia, and especially the structure of exports, points to the need for orientation on high technology products and to achieve competitiveness and recognition in the international market.

The values of FDI in Macedonia during the observed period were varied. Consequently, the highest level was achieved in 2001, 12.6% of GDP, while in 2016 FDI was at the level of 5% of GDP (Chart 5).

Chart 5:

Foreign Investments in Macedonia 2000-2016. (% of GDP)

Source: developed by the authors, based on the World Bank (11), 2017

Values in 2016 represent a continuation of the positive trend, which began in 2014. However, in order to increase the inflow of FDI, Macedonia, like other countries in the region, must create a favorable investment environment, free from a large number of fiscal and other taxes, simplify administration and continue the fight against corruption. Only such systems will attract foreign investors willing to invest funds and stimulate economic development and the necessary structural changes. The global economic crisis has also had an impact on the increase in Macedonian public debt, as shown in Chart 4. The increase in public debt began in 2009 and continued until 2015 when public debt was at the level of 38% And. However, with such increases, Macedonia is below the value of most EU member states (Eurostat (5), 2017).

Chart 6:
Debt Movement in Macedonia in 2000-2015. (% of GDP)

Source: developed by the authors, based on the Eurostat (4), 2017
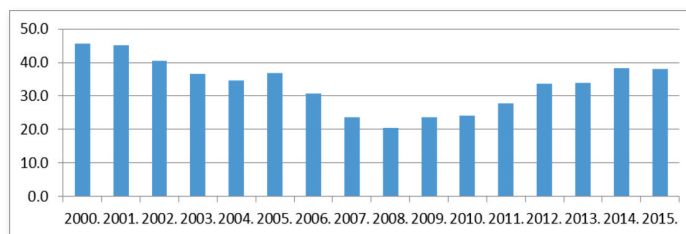
The analyzed data indicate still significantly lagging behind of the Macedonian economy in the process of joining the EU. As major obstacles to this are the over-orientation of the agricultural sector and the orientation of industrial activity to traditional sectors, which can not guarantee the achievement of competitiveness and convergence. Furthermore, as the biggest restriction of adaptation to the EU is unfavorable social situation characterized by very high unemployment rates and a high share of the population at risk of poverty and social exclusion.

This all presents a challenge and a foundation for the launch of radical structural changes, based on the modern growth engines, ie investments in R & D and their products, which has been recognized in all developed European and world economies. The Macedonian economy must find ways of overcoming historical mortgages, political instability and economic downturns and direct economic and social trends to the requirements of modern business conditions.

4. PREVIOUS RESEARCH

Considerations on the importance of the investments in research and development as factors of economic growth have been updated in the 50's and 60's of the 20th century under the neoclassical theory of economic growth. It is based on the Solow-Swan model, which, along with the traditional factors of production (labour and capital), the technology has been identified as a key factor in long-term economic growth (Solow, 1956). Therefore, Solow (1957) considers the situations in which there is no technological progress, where the level of technology is constant, and the situation where is a technological advancement, i.e. when the level of technology is variable. Accordingly, technological progress represents a by-product of investment in physical capital in the companies.

Occurrence of the endogenous models during the 80's and 90's of the 20th century resulted in the reconsideration of existing, neoclassical models and the introduction of new economic growth theories with a special emphasis on the importance of knowledge, namely investment in R&D and education with the aim of accumulation of knowledge which leads to economic growth and the emergence of new products of higher quality. Unlike neoclassical theories, endogenous theories imply knowledge that is not only public good. In addition, it has the status of a market good determined by rivalry and exclusivity. Significant contributions to the model development were provided by Romer (1986 and 1990) and Lucas (1988), Grossman and Helpman

(1991), and Aghion and Howitt (1992). Romer (1986) points out that knowledge transfer results in positive effects in the form of technological innovations and emphasizes that increasing production directly depends on the amount of workforce involved in research and development processes (Romer, 1990). Also, according to Grossman and Helpman (1991), technological development is explained by the growth in the number of products, which is simply equated with the process of innovation development.

When considering the investment in research and development in the context of economic growth, the importance of education should be considered as well. The correlation between education and the achievement of GDP growth was discussed in the research of Mincer (1974), Easterlin (1981) and Steven and Weale (2003). Pereira and Aubyn (2009) and Solaki (2013), with the analysis of Portugal and Greece, observe the education from the macroeconomic aspect, while Bouaissa (2009) and Ahmed (2009) make it from a microeconomic point of view. Puljiz (2009), by the research conducted at the level of the Republic of Croatia, highlights the importance of the population with completed secondary education in the process of achieving economic growth, resulting from a higher representation of highly educated workforce in low productivity sectors.

Contemporary concepts developed in 2000, introduce new terms such as "new industrial space", "industrial clusters," "innovative miles," "self-learning regions," or "regional innovative systems" (Lawson, 1997). Audretsch and Feldman (1997) analyze the importance of geographic space in the process of transferring knowledge and information. According to these authors, the price of knowledge transfer increases as geographic distance increases, while as the most efficient instrument of its transmission, the frequent communication, i.e. the system face to face is identified. Grilliches (1998) and Barro (1998) explain the impact of increasing the level of investment in research and development on overall productivity at the enterprise level, industry, and the overall economy.

Chesire and Malecki (2005), by introducing the term of regional innovation systems, emphasize the importance of concentrating highly-innovative companies that constantly and planned investments in new technologies while maintaining close relations with other relevant actors in the region, especially educational institutions, local and regional authorities, etc. Furthermore, Aghion et al. (2005) emphasize the importance of investing in research and development as a key driver of socio-economic changes. Namely, the authors point out that the most developed countries are responding to economic globalization through the promotion of science and technology policies, with the aim of ensuring competitive advantages and creating new jobs and representing the instrument of solving the growing global problems. Šimurina (2004) analyzes the technological performance of central and eastern European countries. The author concludes that the sources of growth differ between observed countries, emphasizing the dominance of Hungary and the Czech Republic in the export of high-tech products, while on the other hand, Slovenia occupies leading positions in the number of patent applications, research engagement and overall investment in research and development. Also, the author points out that the planning of future development strategies needs to take into account the historical heritage. Furthermore, by observing the same group of countries, Šimurina (2006) concludes that technology has a certain influence on the development of this group of countries. However, technology transfers, in this case, did not prove to be significantly effective in boosting economic progress. Audretsch et al. (2006) emphasize the importance of universities as the carriers of economic growth, job creation and achievement of the international competitiveness. The results of their research indicate the propensity of scientists to launch entrepreneurial activities and, through it, the commercialization of their own innovations.

From all of the above, the importance of entrepreneurial education arises. Empirical research supports positive relationships between entrepreneurial activity and economic results, such as economic growth and innovation (Van Praag and Versloot, 2007). One of the most acknowledged and accepted economic growth theories are based on empirical results that support the economic importance of entrepreneurship provided by Schumpeter (1911). Basically, these models are the idea that entrepreneurs are looking for profitable opportunities and therefore introduce new combinations or innovations (Van Praag, 1999). These new combinations are the main cause of development in the economic system because new business combinations destroy the balance in the economy and create new so-called creative destruction (Ayres and Warr, 2009:164).

Consequently, the education seems to be important to encourage entrepreneurship for several reasons (Reynolds et al., 1999, Sánchez, 2010a). Firstly, education provides individuals with a sense of independence of autonomy and self-confidence. Secondly, education raises people's awareness of alternative career choices. Thirdly, education expands the horizons of individuals, making people better prepare for perceiving opportunities, and provides the knowledge that individuals can use to develop new entrepreneurial opportunities. In order to start their own ideas, they develop the skills, knowledge and attitudes that are necessary to create the entrepreneurial culture. Nowadays, entrepreneurship education is recognized as a priority in the Europe 2020 strategy, within the European SME Policy and in key EU education and training strategies. More and more countries are recognizing the importance of entrepreneurial education and invest more in its implementation.

Considering the investment in research and development as a factor of economic growth and convergence Fagerberg et al. (1997) and Mankiew et al. (1992), accept the current thesis according to which less developed countries are growing faster than developed, under the condition of convergence towards common stable states, i.e. those countries or groups of countries with which they share common structural features (technology level, saving rate, population growth, etc.). Also, it is necessary to consider the structure of total investments in research and development, i.e. investments of public sector, business sector, higher education sector and the private non-profit sector. Also, Fagerberg et al. (1997) point out that the effects of investment in research and development cannot be manifested in the short term and emphasize the importance of the business sector investments. Namely, such investments are aimed at creating innovation, which must be implemented and succeeded in the market, what directly contributes to national competitiveness and economic growth. Furthermore, Guelllec and Pottelsberghe (2001) point to the effects of business sector investment from the spillover aspect and the absorption capability of technology from abroad of the public sector and the university. Therefore, in order to achieve economic growth, countries must open their boundaries and allow free access to foreign technologies and put their products in the function of achieving the prosperity (Damien et al., 2003). Dabić (2007) points to the lack of business sector investment in research and development activities and their implementation on the market, as one of the main reasons for lagging behind the EU for major competitors (USA, China, South Korea, etc.).

Similar conclusions have been made by analyzing the investment of the business sector in the Republic of Croatia in the process of joining the EU (Bečić and Dabić, 2008). Also, authors as the other "weak" sides of the Republic of Croatia emphasize unfavorable position in global science, technological lagging and poor implementation of scientific products in the entrepreneurial and industrial sectors, which is recognized as an aggravating circumstance in adapting to the EU economy. Almost the same conclusions are present in the papers of Prodanović et al. (2013), Krstić and Đunić (2014) and Švarc (2014), Tomljanović and Grubišić (2016), who are analyzing along with the Republic of Croatia the situation in other countries of the region (the Western Balkans). The authors emphasize the low level of investment in research and development, the inadequate engagement of the business sector and the lack of cooperation between universities and the economy in the process of commercialization of innovation. Furthermore, as a major problem is the closed-mindedness of the scientific systems themselves, i.e. the low mobility of scientists, teachers and other staff and students, the international dispersion of research results, as well as insufficient cooperation of institutions with relevant international partners. This has resulted in the emergence of two negative processes, namely brain drain and brain waste (abandoning jobs in the research sector and leaving for better-paid jobs).

## 5. ANALYSIS OF INVESTMENTS IN RESEARCH AND DEVELOPMENT IN MACEDONIA

Investments in R&D in Macedonia have, with certain exceptions, been steadily increasing since 2007. Consequently, the largest growth was realized from 2012 to 2014, when investments in research and development in Macedonia were 0.52% of GDP. (Chart 7). However, the reduction was achieved in 2015 and a new growth was achieved in 2016 when investments in R&D were at the level of 0.44% of GDP. It can be

concluded that Macedonian investments in research and development are still very low compared to the EU average (2.03% of GDP) (Eurostat (7), 2017).

Chart 7:

Investments in R & D in Macedonia for the period 2000-2016 (% of GDP)

*Source: developed by the authors, based on the Eurostat (6), 2017*
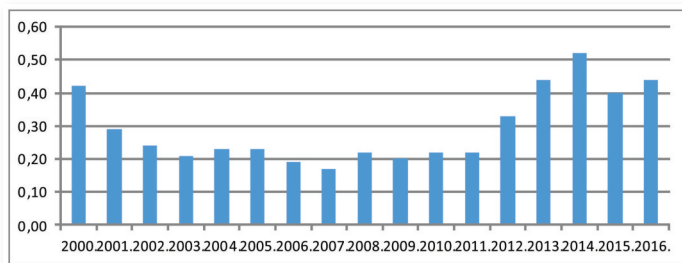
Furthermore, a better picture of investments in R & D in individual countries it is possible to get by analyzing its structure. In this context, it is necessary to look at the investments of the business sector, the public sector, the higher education sector, the private non-profit sector and foreign investments (Chart 8).

Chart 8:

Investments in R&D in Macedonia by source of funds (% of total investments)

Source: developed by the authors, based on the Eurostat (14), 2017
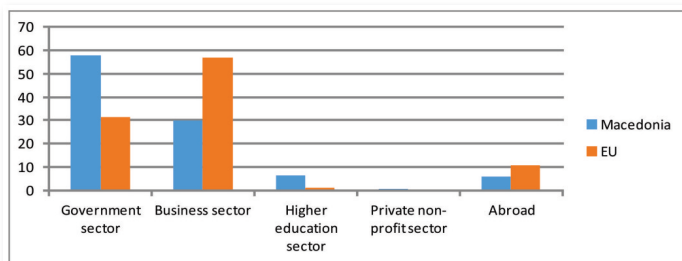
Most of the investment in research and development in Macedonia is financed by public sector activities ie 57.8% of total investment, followed by investment in the business sector (29.8%) and the higher education sector (6.4%). The smallest part of the total investment refers to the foreign investment and private non-profit sector investment. On the other hand, the EU's largest share of R & D investment is funded by the business sector's contribution, which accounts for 56.8% of total investment. Then followed by public sector investment (31.8%) and foreign investments. The smallest share at EU level also goes to private non-profit sector investments.

Nevertheless, in the case of Macedonia, it is necessary to further explain the structure of investment in research and development. Investments in research and development are undertaken by the higher education sector often do not have an economic function, ie they do not contribute to economic growth. The problem arises from the fact of low market commercialization of scientific research products resulting from scientific activities at universities. Such a situation in Macedonia as well as in other countries of the region imposes the need to strengthen the linkage between the academic community and the entrepreneurial sector, in order to initiate structural reforms and start up the economy.

Small and medium-sized enterprises that are the cornerstone of the world economy should intensify their scientific research activities and thus further increase their contribution to achieving progress and convergence processes. Nevertheless, the unfavorable entrepreneurial environment and the consequences of the global economic crisis in Macedonia and other countries of the region slow down this process and direct the interest of small and medium-sized enterprises towards survival, with an orientation towards new knowledge and technology taking a secondary role. According to available data, 52.6% of small and medium-sized enterprises in Macedonia survive, while 14.3% per year do not survive (Eurostat (8), 2017).

Contemporary theoretical approaches emphasize the crucial role of the workforce, ie their education and training in the process of achieving economic growth and the achievement of convergence. Such approaches impose the need to increase public investment in education and the participation of the population in lifelong learning programs.

At the level of Macedonia, 9.4% of the population aged from 18 to 64 are included in lifelong learning programs. In the observed period, the highest values were achieved in 2011 when 11.4% of the population aged from 18 to 64 were included in some form of lifelong education (Chart 9). However, comparing with the EU average in 2016 (16.6%), there is a significant lag in this indicator as well.

Chart 9:

Participation of the population aged from 18 to 64 in lifelong learning programs in Macedonia for the period 2000-2016 (%)

*Source: developed by the authors, based on the Eurostat (11), 2017*
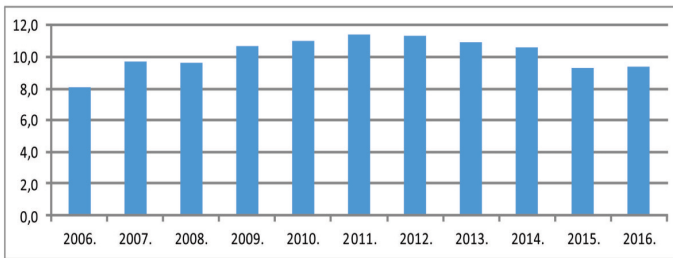
This situation arises as a direct consequence of the unfavorable economic and social situation in which the population is oriented towards survival and the provision of sufficient resources for normal life. Also, there is still insufficient awareness of the importance of continuous improvement and improvement in order to improve their own position and adaptability in the labor market.

Such a situation requires the increased engagement of political authorities in increasing total investment in education and enabling broadly accessible and financially acceptable education and training programs. Investments in education in Macedonia have started to increase since 2007, and this process (with the exception of 2011) required until 2012 when the level of 4% of GDP was reached (Chart 10). Such values represent a lag behind the EU average, with education accounting for 5.28% of GDP (World Bank (11), 2017).

Chart 10:

The trends of public investments in Macedonia in the period 2001-2012 (% BDP-a)

*Source: developed by the authors, based on the Eurostat (9), 2017*
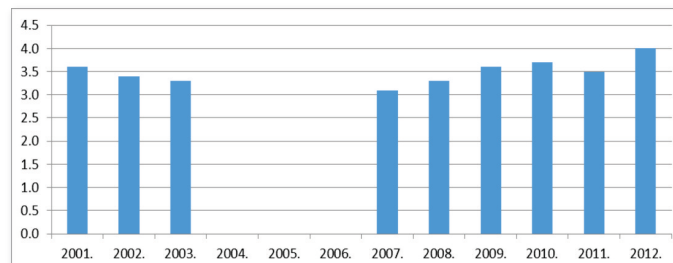
Total investments in education have had a positive impact on the share of the population aged 30-34 with completed tertiary education. Namely, the data presented in Chart 11 point to a steady increase in persons with completed tertiary education in the period 2007-2014. According to the latest available data, 24.9% of the population aged 30-34 in Macedonia have completed tertiary education. Still, despite the steady growth, Macedonia also lags behind in this indicator for the EU. Namely, at the EU level, 39.1% of the population aged 30-34 have completed some form of tertiary education (Eurostat (10), 2017).

Chart 11:

Population aged 30-34 with completed tertiary education in Macedonia in the period 2006 - 2014 (%)

*Source: developed by the authors, based on the Eurostat (9), 2017*
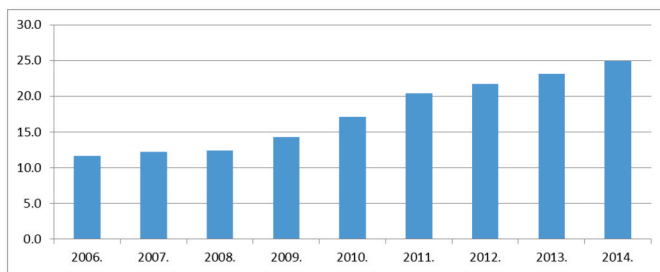
Furthermore, the higher education sector in Macedonia produces 0.2 new doctors of science per 1000 inhabitants, which is somewhat lower than the EU average (Eurostat (11), 2017).

Positive trends in education and the recognition of science and contemporary trends as a key condition for achieving economic growth have resulted in an increase in the number of employees in the science and research sector. Increased employment was started in 2009 and with certain exceptions continued until 2014 (Chart 12).

Chart 12:

Number of employees in science and technology in Macedonia in the period 2005 - 2014

Source: developed by the authors, based on the Eurostat (9), 2017
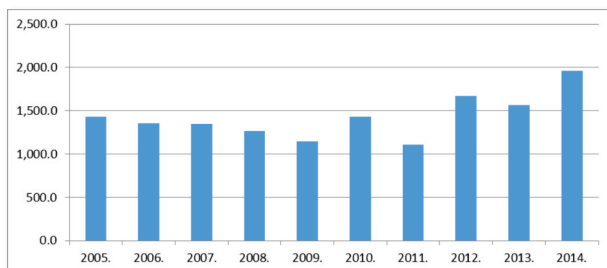
As mentioned above, such a situation is an opportunity but also a challenge in the commercialization of product research by employed scientists and their use for the purpose of economic growth.

The relationship between R & D and achievement of economic competitiveness of a country can be assessed on the basis of the share of high technology products in total exports. Data presented in Chart 13 indicate relatively positive trends in this segment in the period 2007-2015. years. Namely, in the observed period, the share of high technology products in total exports increased significantly compared to the beginning of the period and in 2015 it was cut off by 2.7%. However, in this segment, Macedonia is far below the EU average (17% of total exports in 2015).

Chart 13:

High tech product share in total exports in Macedonia in the period 2007-2015 (%)

Source: developed by the authors, based on the Eurostat (12), 2017
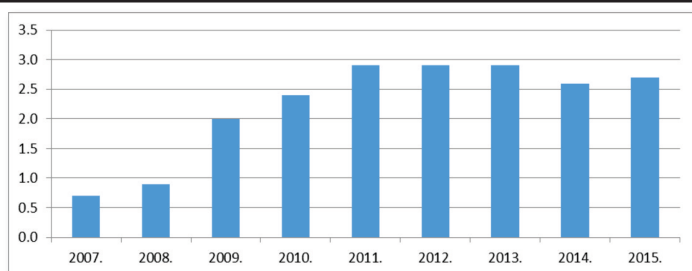
The analysis of the key indicators of investment in research and development in Macedonia shows positive progress in some areas, as well as the still significantly lagging behind the EU average. In this regard, the biggest constraints are the high orientation of investments in the higher education and public sector sectors

and the low levels of SME activity in scientific research activities. Furthermore, as a logical consequence of such a situation, there is a low level of high-tech products in total exports, which limits the ability to achieve international competitiveness and adapting to EU requirements in the process of achieving full-fledged membership.

All these limitations represent a challenge in the further integration process. The bearers of economic and political activity in Macedonia must create the conditions for launching structural changes, fundamental to invest in research and development and their products. As a necessity, dynamic management of structural changes is imposed. This is a relatively unexplored field of economic science, and this work has made the first step towards his further affirmation. The authors of this paper are of the opinion that dynamic management primarily requires the definition of quality measures and the creation of conditions for their implementation. The success of such a process requires the synergy of all involved entities and their coordinated efforts in achieving a common goal.

Therefore, a key development strategy is presented below, whose goals Macedonia must fulfill in the process of achieving full EU membership. Based on the available strategic documents, the authors of the paper suggest the development direction of the Macedonian economy.

5. MEASURES FOR IMPROVING INVESTMENTS IN RESEARCH AND DEVELOPMENT IN MACEDONIA

Investment in research and development in Macedonia, as well as in other countries of the Western Balkan and the EU member states has been recognized as one oft he crucial factors to achieve economic growth and competitiveness of national economies and „necessary" step int he transition to a „society" of knowledge.

The basic goal of Innovative strategies in Macedonia is *"the transformation of the economy into a knowledge-based society capable of competing on the international market, through a highly educated workforce and innovation-oriented enterprises."*

The implementation of innovation policies and achieve the goals of Innovative strategies of Macedonia takes place in close connection with other development documents and strategies at the forefront of investment in research and development, competitiveness, industry and joining the EU. As the most important strategic documents are necessary to allocate the National Programme for research and development in the period 2012 - 2016, Program to promote and support technological development (2012-2015) and the Industrial policy of Macedonia in the period 2009-2020 (Figure 1).

Figure 1:
Strategic framework of innovation policies in Macedonia

Source: developed by the authors, based on Innovative strategies in Macedonia in the period 2012 – 2020

The basic goal of National Programme for research and development is to achieve the level of investment in research and development 1% of GDP by 2017, ie, the level of 1.8% of GDP by 2020. Also, the Program stipulates the necessity of increasing the business sector investment in research and development on 50% of total investments by 2020. In addition to the basic goals, the Program is focused on five key thematic areas, to earn a competitive economy based on knowledge and innovation, the creation of low-carbon economy, sustainable development, security and crisis management and socio-economic and cultural development.

Program to promote and support technological development is focused on the implementation of the priorities of the strategy EUROPE 2020 (smart, sustainable and inclusive growth), strengthening the industrial sector and to create the preconditions for economic growth based on knowledge and innovation. Generally, the program is focused on research, the creation of knowledge and diffusion of technology for the development of industries.

Industrial policy of Macedonia aims to increase the competitiveness of industry and the economy through knowledge, innovation and research through orientation on five key areas: a) international cooperation and encourage foreign direct investment, b) applied research and innovation, c) environmentally acceptable products and services, d) the development of SMEs and e) cooperation through clusters and "network".

Innovation strategy of Macedonia in the period 2012-2020 pursues four key goals:

1. Encouraging business sector investment in R & D activities

2. Strengthening Human Resources

3. The creation of effective legislative environment

4. Increased mobility and collaboration among holders of innovation activities.

Goal 1 is planned through the implementation of activities that will increase awareness of SMEs on the potential benefits of innovation (consultation, workshops, and promotional activities) and the establishment of the Fund for Technology and Innovation, which will provide the means for concurrent small and medium enterprises in implementing innovation process. In addition, this area includes technical assistance, the establishment of university spin-off companies, commercialization of innovations, support eco-innovation and stimulate private investment in research and development.

As key areas to achieve goal 2 are determined by adjustment of the education system to labor market needs, rewarding the best individuals (students, lecturers, researchers), improvement of professional training and the promotion of lifelong learning and the modernization of tertiary education.

The creation of effective legislative environment (goal 3) is possible through the formation of a unified and efficient framework for scientists and research institutions, adjustment of the public procurement in order to stimulate innovative activities and the creation of a competitive business environment (modernization of the competition rules).

Increased mobility and collaboration among holders of innovation activities (Goal 4) is planned by increasing the number of clusters and to encourage their cooperation, strengthening the connection between research institutions and the economy, strengthening cooperation with foreign countries and security mechanisms for attracting foreign direct investment.

The achievement of key economic and strategic goals of Macedonia (full membership in the EU, economic growth, sustainable development and increase the competitiveness of the economy) means coordinated actions and fulfillment of the goal and priorities of key strategic documents, which are the most important areas identified like promotion of technological development, strengthening the scientific and technological basis industry and the development of SMEs. In accordance with the orientations of the strategic documents, as well as key development "leverage" identifiable investment in research and development, Enterprise and Industry and International Cooperation (Figure 2).

Figure 2:
Key development "leverage" of the economy of Macedonia

Source: developed by the authors

Innovation strategy of Macedonia proclaimes as a basic goal increasing of investment in research and development at the level of 1% of GDP by 2017, ie. 1.8% of GDP by 2020. The special attention is paid to the development of industry in the changed conditions, ie, re-industrialization, which will guide the key holders to the industrial production of high technology products. Also, increased investment in research and development in small and medium-sized enterprises, are providing the conditions of funding and technical support to increase their competitiveness and recognition on the international level and make them "engines" of economic development. Economic activity in the modern business conditions are based on the connection between the research sector and small and medium enterprises, and it is, therefore, necessary to strengthen their cooperation and to implement the adjustment of the education system (particularly high) so that will be compatible with the needs of the business sector and the general labor market. Excellence, progress and competitiveness in the field of scientific research can be achieved only through international cooperation and networking with key regional and EU actors. Connectivity, coordination and concerted implementation of the three listed "leverage" to influence the initiation and acceleration of structural reforms in Macedonia, transformation towards "knowledge society" and the adjustment of its economy to modern demands of the EU.

Along with national strategies, Western Balkan countries including Macedonia should focus on the achievement of the objectives and priorities of regional strategies, of which the most important is the Western Balkans Regional R&D Strategy for Innovation.

The Strategy was defined in 2013 in order to create the foundations for reform of policies and institutional reforms, and promote the increase in innovation, economic growth and prosperity. The implementation of the Strategy will provide the countries of the Western Balkans with a number of opportunities for human resources development and financial leverage and will contribute to the creation of a political platform for the continuous promotion of policy reform and capacity building for the mobilization of external funding for research funding. The regional cooperation of R&D countries will also result in positive environmental pressures and will be an indicator of countries' orientation for the European Research Area (ERA) (World Bank, 2015).). This Strategy imposes the main goal on the Western Balkans which is the achievement of the level of investment in research and development of 1.5% of GDP by 2020.

Along with the fundamental objective, the Strategy is focused on meeting the four additional goals:

1. improving the science base and research excellence,

2. fostering cooperation and technology transfer between research institutions and industry,

3. creating the conditions for industrial innovation and innovative start-ups and

4. improving innovation management and innovation policies.

With the aim of achieving the objectives set out in the Regional Strategy for Innovation, the Action Plan for Regional Co-operation has been defined, proposing five regional initiatives, covering all aspects of research and development. The achievement of the Action Plan will be more effectively implemented through a financial assistance instrument called Western Balkans Research and Innovation Strategy Exercise Facility (WISE).

Within WISE, four programs have been proposed:

1. the establishment of the Research Excellence Fund, which aims to encourage cooperation between local researchers and scientists from abroad as well as the development of young scientists

2. a network of excellence development programs

3. a program of technological transfer, aimed at promoting cooperation between the research and business sectors

4. start-up program.

In addition to the previously analyzed National Strategy and the Regional Strategy for Innovation of the Western Balkans, Macedonia and other Western Balkan countries should put great emphasis on achieving the goals of the EUROPA 2020 Strategy, whose fulfillment positively influenced their integration processes, economic recovery and preparation for full EU membership.

The Europe 2020 Strategy, adopted in 2010, is a ten-year strategy, whose goal is to create Europe the fastest growing and most competitive knowledge based economy in the period up to 2020.

The most important priority of the Strategy is smart, sustainable and inclusive growth. Smart growth implies the development of knowledge-based and innovation-based economic activity. Sustainable growth endeavors to secure economy that makes efficient use of resources and inclusive growth is focused on the achievement of high rates of employment, which will contribute to social and territorial cohesion (Agency for mobility and EU programmes, 2015).

In close connection with the main priorities, five main objectives of the Strategy focused on employment, research and development, climate change and energy sustainability, education, and the fight against poverty and social exclusion (European Commission, 2015).

In the area of employment, the goal is to achieve an employment rate of more than 75% (population aged 25-64). The research and development goal implies investing in research and development at a level of 3% of GDP by 2020. Climate change and energy sustainability are based on achieving 20/20/20, ie reducing greenhouse gas emissions by 20% (or 30% if there are conditions) compared to the 1990 level, obtaining 20% of total renewable energy sources and increase energy efficiency by 20%. Furthermore, in the area of education, it is envisaged to reduce the early school leaving rate to below 10% and to increase the share of persons between 30 and 34 years of age with completed tertiary education at 40%. The goal of poverty alle-

viation and social exclusion is to reduce the number of people living at risk of poverty and social exclusion for at least 20 million.

In order to achieve priorities, the EU has defined seven key initiatives. The initiatives needed to achieve smart growth include: Innovation Union (encouraging investment in research and innovation and strengthening the innovation chain), Encouraging the Young (strengthening education systems and facilitating labor market change) and the Digital Agenda for Europe (ICT and fast Internet application).

In the area of inclusive growth, the Agenda for New Jobs (employment, training and modernization of the labor market) and the European Platform Against Poverty (social and territorial cohesion and inclusion) are being implemented, while the priority of sustainable growth is realized through Resource Efficient Europe (the fight against climate change and clean and efficient energy) and the Industrial Policy of the Globalization Era (creating a better business environment and strengthening the foundations of the industry, thus ensuring a higher level of economic competitiveness) (Agency for mobility and EU programmes, 2015).

Using the exponential smoothing method, a projection of investment in research and development in Macedonia and the EU from 2017 to 2025 (Chart 14) was carried out. The projection results indicate that investment in research and development in Macedonia in the forthcoming period, after a slight decrease in 2017, will continue to increase. However, the increase will take place at a slow pace and by the year 2025, it is expected to reach 0.48% of GDP (Chart 14).

Chart 14:
Projection of movement of investments in R&D in Macedonia and the EU in the period 2017-2025 (% of GDP)

Source: authors' calculations
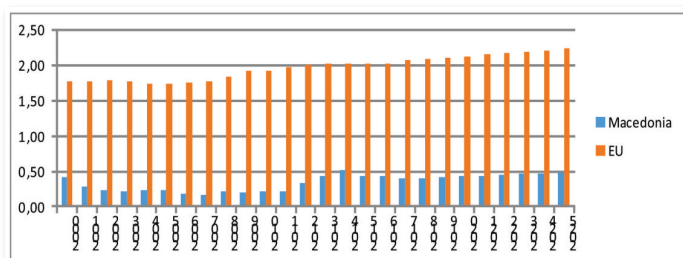
Furthermore, a similar situation is present at EU level where investment in research and development is expected to reach a level of 2.24% of GDP. Such values represent some progress, but they will still be lower than those set out in the EUROPA 2020 strategy, which proposes to invest in research and development of 3% of GDP. However, the time period for the implementation of the Strategy is slowly coming to an end and questioning the achievement of the goals set, which has largely contributed to the negative consequences of the global economic crisis. Furthermore, the issue of future trends and the EU goals in the area of achieving the knowledge economy and the achievement of the digital transformation of the economy is raised. The key question is: *Should the EU set unrealistic or difficult targets or to define more easily achievable priorities based on previous achievements, taking into account the national specificities of the member states but also the candidate countries that are believed to soon have full EU membership?*

Taking into consideration the different national specificities and the uncertainty and dynamism of the contemporary economic environment, the results of projections should also be taken with a certain amount of reserve. Namely, they represent the values that have come about on the basis of the achievements so far. However, the economic systems of the countries are dynamic elements sensitive to changes in the environment, with deviations largely determining trends in future trends. Especially in terms of investing in research and development and their products, which represent an extremely sensitive area.

7. CONCLUSION

The research carried out has identified significant development lagging behind the Macedonian economy for development levels in the EU member states. As a major problem, however, it is still high orientation towards the activities of the agricultural sector, the tradition of the industrial sector and the lack of employees in service industries. Furthermore, Macedonia is characterized by a very difficult social situation characterized by high unemployment, low wages and a significant share of the population at risk of poverty and social exclusion. This situation results in significant social unrest, dissatisfaction and other disadvantages that slow down the progress and convergence of the developed EU member states.

This economic situation imposes the need for orientation towards contemporary sources of economic growth, ie investment in R & D and their products, which is recognized as the main driver of economic growth and structural changes in the work of relevant economic theorists. However, this area is still insufficiently explored in the works of Macedonian authors and authors from other countries of the region. The fundamental scientific contribution of this paper derives from the systematization of the current research on the importance of investment in research and development in the process of economic growth and the analysis of the current situation in this sector in Macedonia. Namely, as has been mentioned several times, the authors have encountered the problem of the unavailability and unsystematisation of key indicators of investment in research and development, which has relatively limited the scope of research. The collected and presented data will represent a quantitative basis for future research. Furthermore, the scientific contribution of work derives from the definition of the authors' development strategy, which as a key element of progress and further EU integration emphasizes the need to increase investment in R & D, their integration with the business sector and further foster international cooperation and internationalization of education systems and the entire economy. Only such an approach guarantees the successful and sustainable integration of Macedonia into the EU. Ultimately, the scientific contribution of the work comes from the projections of investment in research and development in Macedonia. Namely, the results of the projections suggest that investment in research and development in Macedonia will increase by 2025, but this process will take place at a slow pace. Such a situation is a challenge in the process of dynamic structural change management, which requires the close co-operation of all actors, especially the economic and political authorities.

Future research needs to include other Western Balkan countries, where similar research has not been carried out recently. In addition to descriptive research and projection of key variables, future research should focus on quantifying the impact of R & D investment on achieving economic growth and convergence in these countries, as well as identifying the most important indicators in this process.

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