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Research and Development Activity and Innovative Advancement of European Enterprises

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Abstract:

This article is a try of identifying the positive relation between research and development (R&D) and the innovativeness level of enterprises from European countries. Under the article Author examines the role of research and development activity of enterprises in reinforcing innovativeness position in the ranking of innovativeness of European countries. European enterprises are under competitor's pressure what forced them to become more innovative. As the research showed enterprises in European countries are very different in the innovativeness level. It can be observed that companies from new member states (after the year 2004) of European Union significantly diverge from the average for old European countries.

The objective of this article is the identification how the research and development activity influences the innovativeness of enterprises among European countries as well as showing the role of R&D as a determinant of innovativeness of enterprises and economies of European member states.

The analysis takes into consideration industrial and manufacturing enterprises from Europe. Sources of data used in the article were statistic data of European Commission, internal and foreign reports.

Keywords: *Innovativeness, R&D, internal technology transfer, competitiveness*

1. Introduction

The changes placed in the global economy indicate a transformation from a traditional economy to a knowledge-based economy that is based on highly processed products and processes. Level of the transition to a knowledge-based economy responds the competitiveness of individual companies, regions and countries. In a global world, innovations are obviously very important channel for increasing enterprises growth and long-term development.

Innovation is seen as an essential factor of development and improving competitiveness of firms. The activity seeking to gain a competitive advantage among enterprises sector forces them to use factors especially affecting innovativeness.

Innovativeness in the economic dimension refers to the ability of enterprises to continuously acquire and use in practice the results of scientific research, research and development, new concepts as well as ideas and inventions (Olso Manual, 2005). In market conditions company can obtain innovation from external sources and does not conduct its own research and development (R&D) or by running own R&D activity. When the acquisition and implementation of enterprise technology from outside is accompanied by research and development the internal technology process is observed.

The results of the recent Business R&D and Innovation Survey (BRDIS) sponsored by NSF suggest that companies that perform or fund R&D have a far higher incidence of innovation than companies without R&D activity (NSF, 2012).

Research and development and innovation have been recognized as a major driven of country, industry and enterprises economic performance (Raymond, Mairesse, Mohnen, Palm, 2015).

The available resources of organizations determine the effectiveness and efficiency of their functional activities and generate the differences between organizations (Youngsoo, Sang, 2015).

Global competitiveness index presented under The Global Competitiveness Report of the World Economic Forum lists the technological readiness as one of the most important factor of competitiveness. Thus, it considers the technology as an important element of competition and the company's success in the market (Schwab, 2012).

The innovation process is highly complex and uncertain. Intuitively, enterprises with high rates of successful innovation process and this firms are likely to exhibit superior future performance as they are expected to generate unique knowledge through R&D activity.

2. Methodology of the Research

The source of empirical data within this discourse were Eurostat, European Committee works, as well as national and foreign reports concerning innovativeness and R&D activity. The diagnosis of the enterprises innovativeness background is based on the analysis of

the amount of information concerning results of statistics research by Eurostat in terms of innovativeness, innovation activity, research and development activity. The researches include enterprises within Eurostat data from the sector of industrial and manufacturing enterprises. The research was done concerning the data from most European Union Countries and countries which are not the member of EU but geographically are in Europe. Countries which are examined under the research are: Denmark, Finland, Norway, Austria, Sweden, Netherlands, Belgium, Spain, United Kingdom, Italy, Germany, Lithuania, Croatia, Estonia, Latvia, Cyprus, Bulgaria, Slovakia, Slovenia, Hungary, Ireland, Greece, Romania, Portugal, Czech Republic and Poland.

3. Innovative Advancement of Enterprises in Europe

Innovativeness of economies in individual countries is analyzed under the annual Innovation Scoreboard report. Under this report the innovation position of a country is determined by 25 factors (Summary Innovation Index) – starting from human resources (e.g. number of new PhD graduates), through openness of the science system (e.g. number of foreign students, number of scientific publications published in the best journals), public state and companies spending on research and development, and ending with the participation of entrepreneurs in creating innovation.

In the European Union Innovation Scoreboard – from 2015 year, member states were divided into four groups (IUS, 2015):

- innovation leaders (Summary Innovation Index for these countries is more than 20% higher or more than the average for the EU countries),
- innovation followers (Summary Innovation Index for these countries is less than 20% above the average for the EU countries but more than 10% below),
- moderate innovators (Summary Innovation Index for these countries is less than 10% below the average for the EU countries but more than 50% below),
- modest innovators (Summary Innovation Index for these countries is below 50% of the average for the EU countries).

From Community Innovation Survey 2015 it can be observed, that more than half of companies in European Union were classified as innovative enterprises (see Figure 1). Despite this, it is an important difference between countries in their innovativeness index (counted through Summary Innovation Index). The lowest innovativeness level is observed in new European Union member states like: Romania, Bulgaria, Latvia- these countries are in the group of modest innovators. The second lowest innovativeness group - moderate innovators is represented by the countries like: Lithuania, Poland, Croatia, Slovakia etc. The innovation followers group starts with Slovenia which had the lowest innovativeness level in its group. The highest innovation position in the group of innovation followers had Netherlands. The highest innovation position among all of the member states of EU and in the last leaders group - innovation leaders, belonged to Sweden. All the Scandinavian countries were very high positions in the Innovation Survey report.

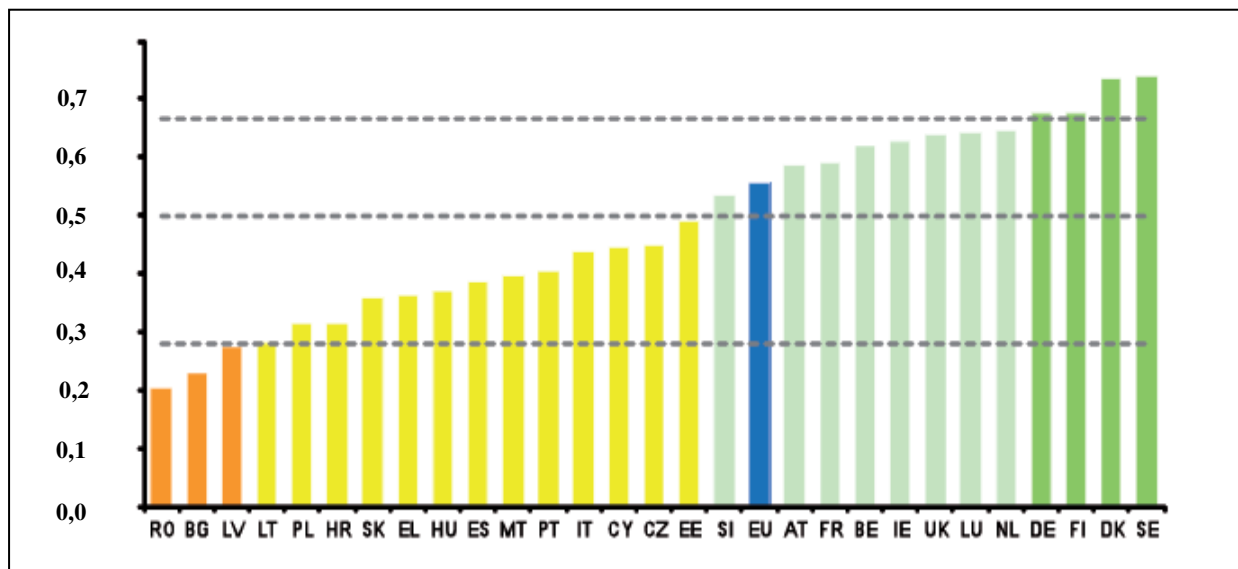


Figure 1: EU Member States' innovation performance in 2015.

Source: Innovation Union Scoreboard 2015, Belgium, EU 2015, p. 5

The most innovative European Union countries have a number of common strengths in national research and innovation systems, which play the key role for innovative entrepreneurship and higher education. All innovation leaders achieve very high rates of investment in research and development and excel in patent applications.

Growth driving forces of innovation in the EU are small and medium-sized enterprises (SMEs) as well as the commercialization of innovations combined with outstanding research systems (IUS, 2013).

In the group of enterprises from industry and manufacturing section share of innovative enterprises in all analyzed countries was the biggest in Germany where 70,3% of industrial enterprises were innovative and 71,8% from manufacturing section were innovative as

well (see Figure 2). The second place in innovativeness in industry (I) and manufacturing (M) group were enterprises from Ireland (66,2% I and 68,0% of M), then from Belgium (60,5% I and 60,9% of M). The lowest innovativeness level was in Romania, where only 22,5% of enterprises from industry and 23,0% of enterprises from manufacturing were innovative in total amount of enterprises. The second last position in the share of innovative enterprises in industry 23,4% and manufacturing 23,6% took firms from Poland. The average for all European member states was 51,0% of innovative enterprises in industry and 51,8% of innovative enterprises in manufacturing sector.

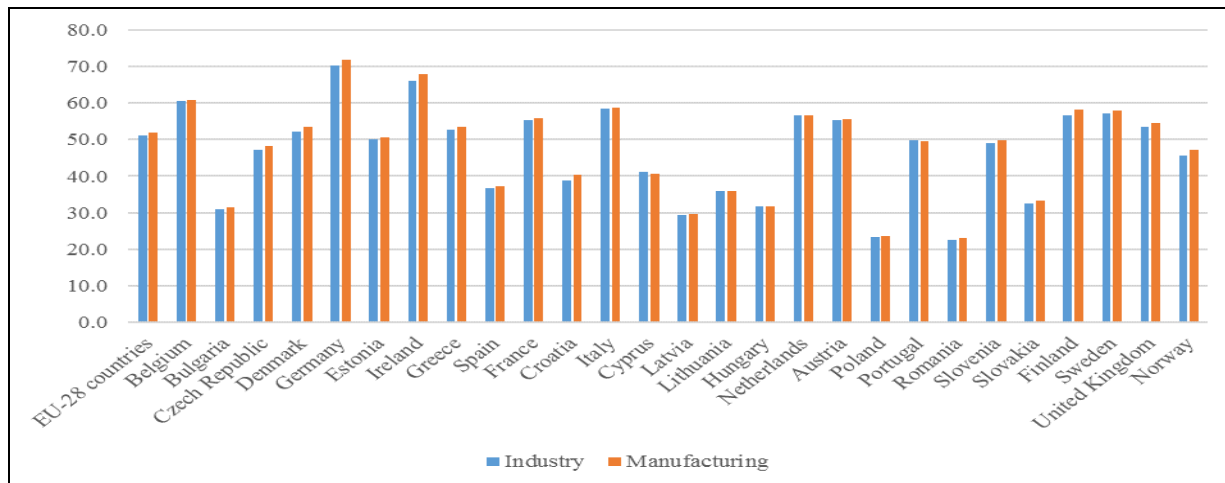


Figure 2: Share of innovative enterprises from industry and manufacturing sector from European countries. Source: Own elaboration based on elaboration based on Eurostat statistics [inn_cis8_type]

4. R & D activity of Enterprises and Innovativeness Development

In the knowledge - based economy it becomes important to run research and development activity. In the context of European Union and the creation of national programs to support innovation in this area it is a fairly difficult issue, because it imposes itself to R&D on the level of 3% of GDP in European union member countries. The share of expenditure on R&D is the actual value of the money put into this activity.

Total intramural R&D expenditures include expenditures of business enterprise sector, government sector and higher education sector. The highest level of total intramural R&D expenditures in 2014 year were in Finland, Sweden, Denmark, Austria and Germany. All of this countries reached the level around 3% of GDP.

R&D intensity (R&D expenditure as a percentage of GDP) reflects the extent of research and innovation activities undertaken in a given country in terms of resources input. The Europe 2020 strategy sets a 3% objective for R&D intensity. Only the most innovative countries have reached this level till 2014 year (see Figure 3). Although all the European Union member states agreed with 3% level of R&D expenditures it is doubtful that they will gain this level till 2020 year.

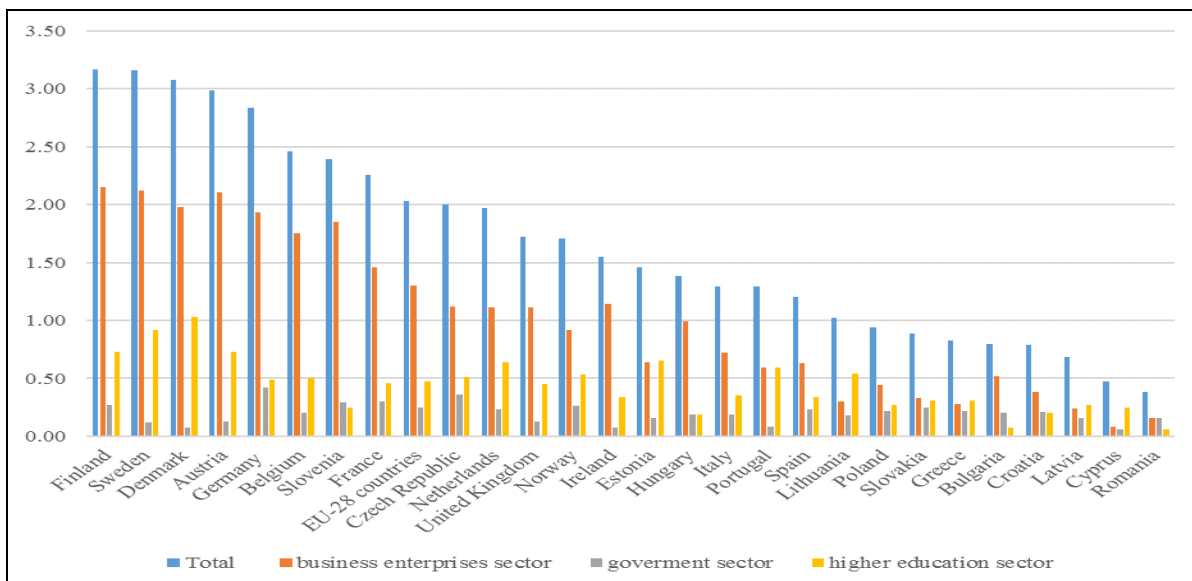


Figure 3: Total intramural R&D expenditure % of GDP by sectors of performance in 2014 year in European countries. Source: Own elaboration based on Eurostat statistics [rd_e_gerdtot].

Examining the research and development activity it is important not only that the company declare that kind of activity but the real incurred expenditures of this company on R&D activity.

The average R&D expenditures of enterprises in 2014 year was for 28 European countries 356,6 euro per inhabitant (see Figure 4). The highest expenditures on R&D in euro per inhabitant had allocated countries like Sweden – 946,2, Denmark - 904,7, Austria - 818,6, Finland- 808,9, Germany - 696,1. The lowest expenditures on R&D activity in euro per inhabitant are in countries like: Romania – 12, Cyprus - 16,7, Latvia - 28,9, Bulgaria - 30,2, Lithuania - 37,1 (rd_e_gerdtot).

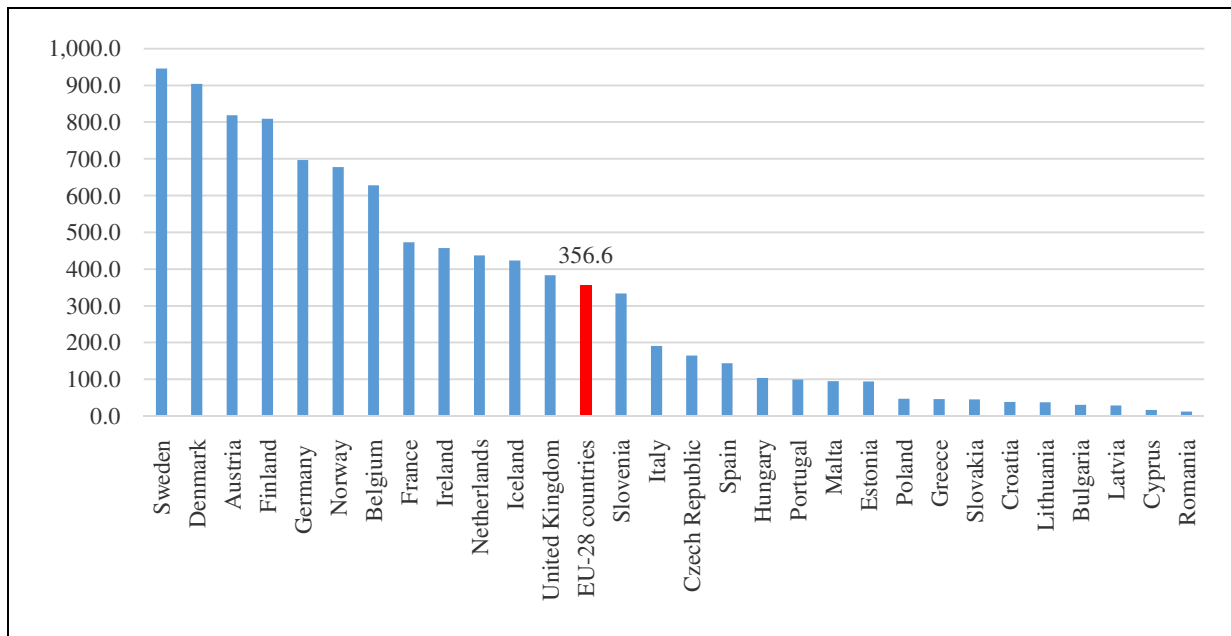


Figure 4: R&D expenditure in euro per inhabitant in business enterprise sector in 2014 year.

Source: Own elaboration based on Eurostat statistics [rd_e_gerdtot].

Research and development personnel consists of all individuals employed directly in the field of R&D, including people providing direct services, such as managers, administrators, and clerical staff. Researches in R&D can be employed in the public or the private sector - including academia - to create new knowledge, products, processes and methods, as well as to manage the projects concerned. The share of R&D personnel in business sector is an important indicator in measuring the innovativeness of enterprises. The highest rate of R&D personnel in business personnel was in Netherlands, Ireland, Slovenia, France, Austria, Denmark, Finland, Belgium, Sweden, Czech Republic and Germany (see Figure 5).

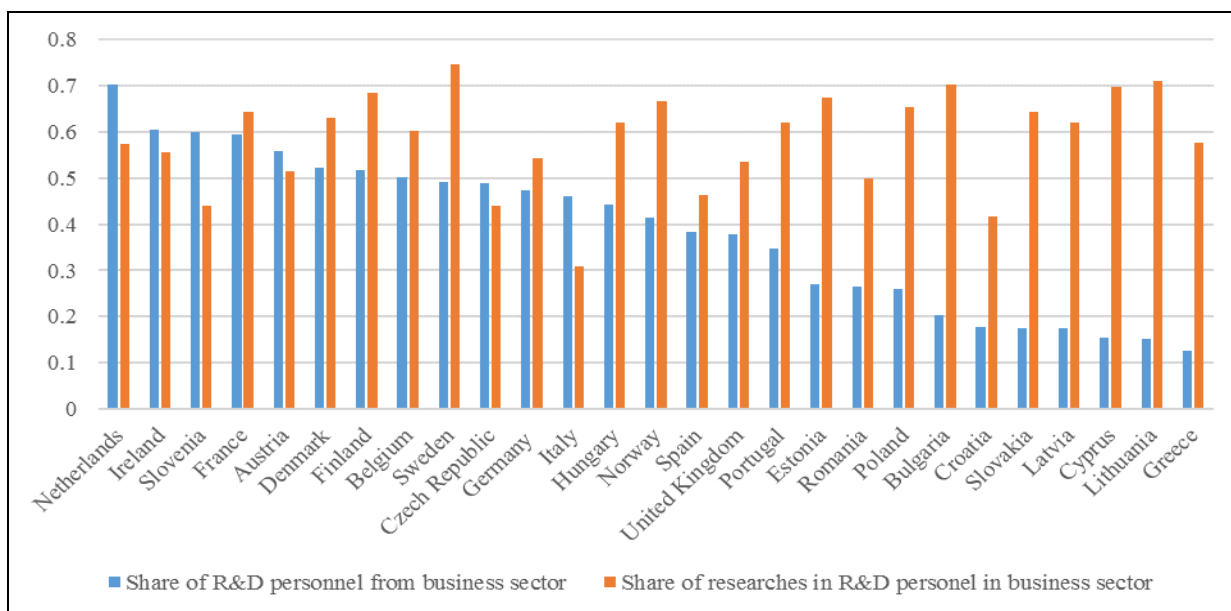


Figure 5: Share of R&D personnel from business sector (%) in all R&D personnel in all sectors (0-1%) in 2014.

Source: Own elaboration based on Eurostat statistics [rd_p_bempocr2].

In Netherlands there were 130 094 R&D people employed in business sector from which 74 632 were researchers. In other innovative countries the share of R&D personnel and researches in R&D personnel in business sector were respectively: Ireland - 24 785 and 13 750, France – 341 091 and 220 321, Austria – 65 320 and 33 643, Denmark 44 418 and 28 030, Germany 408 512 and 221 362 (rd_p_bempocr2). Innovative countries have the higher rate of R&D personnel in business sector in total personnel in all sectors.

The next indicator which influences the innovativeness is the way of financing the R&D activity from the national level (see Figure 6). In Germany national public funding to transnationally coordinated R&D were on the level of 1002,3 million euro, from which 271,9 million euro were national contributions to transnational public R&D performers and 713,8 million euro were national contributions to Europe - wide transnational public R&D programs. In Finland it was in sequence 78,355, 17,334, 49,341 million euro, in Norway 92,935, 24,863, 61,586 and in Netherlands 177,157, 53,712, 123,445 million euro (gba_tncoor).

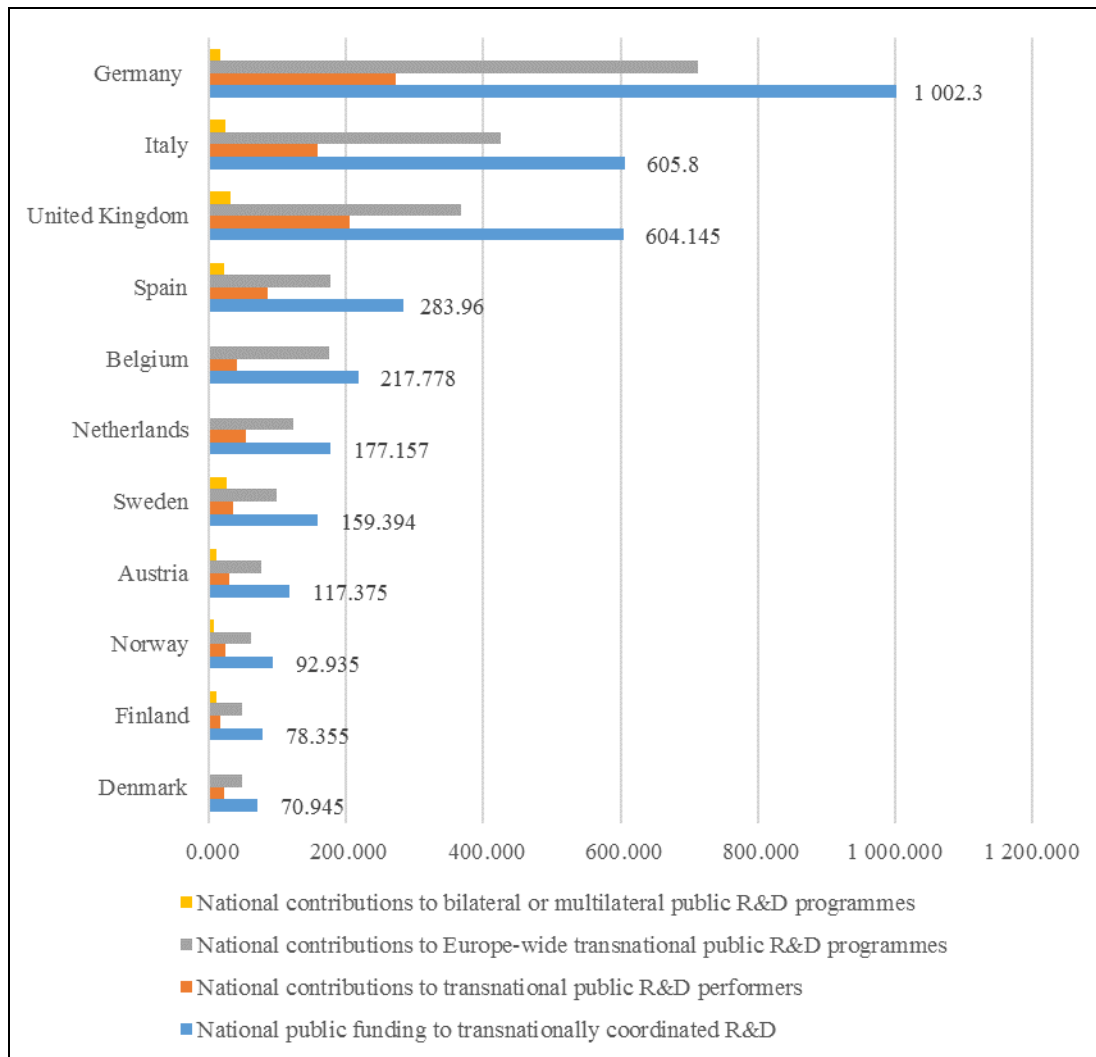


Figure 6: National public funding to transnationally coordinated R&D (Million euro) in 2013.
Source: Own elaboration based on Eurostat statistics [gba_tncoor].

Countries which present low innovativeness level had in 2013-year low national funding to transnationally coordinated R&D in million euro (see table 1).

	National public funding to transnationally coordinated R&D	National contributions to transnational public R&D performers	National contributions to Europe-wide transnational public R&D programs	National contributions to bilateral or multilateral public R&D programs
Lithuania	1,043	0	1,014	0,029
Croatia	1,198	0,449	0,536	0,213
Estonia	1,2	0,3	0,9	0
Latvia	2,004	0	1,503	0,501
Cyprus	2,084	0	1,611	0,473
Bulgaria	3,116	2,566	0,215	0,335
Slovakia	6,562	5,623	0,518	0,42
Slovenia	6,685	0,045	6,641	0
Hungary	7,787	6,224	1,563	0
Ireland	19,597	1,3	18,221	0,076
Greece	28,96	9,67	17,5	1,79
Romania	29,719	6,53	22,709	0,479
Portugal	33,343	15,295	16,235	1,813
Czech Republic	38,323	14,004	22,676	1,642
Poland	44,479	34,616	7,171	2,692

Table 1: National public funding to transnationally coordinated R&D (Million euro) in 2013.

Source: Own elaboration based on Eurostat statistics [gba_tncoor].

5. Conclusions

Research and development activity plays a very important role in the innovation process. Its level of sophistication and intensity and effectiveness determines the innovativeness of companies and entire economies.

European Union authorities recognize the importance of working in research and development segment, so the question of their development has been concluded in the official Europe 2020 strategy, which is a continuation of implemented in 2000-2010 Lisbon Strategy.

All innovation leaders achieve very high rates of investment in research and development. The analysis showed that countries that joined the European union after 2000 year have long distant position in share of R&D activity in GDP and also in financing R&D by the business sector. It influences the innovativeness of enterprises. Countries with low investments in R&D activity have less innovative enterprises. It seems, that the low level of innovativeness of enterprises in this countries is due to the financial situation of this enterprises. Firms from low innovation countries have less money to invest and develop the risky and uncertain situation of R&D activity. Entrepreneurs often have limited own resources and limited access to external sources. Firms from new member states of European Union invest their money on technology transfer connected with acquisition of machinery, equipment and software instead of R&D activity. On the other hand, it can mean that development level of this countries is not enough advanced for sufficient to adopt a strategy aimed research and development activity as the main source of innovativeness.

This proposal also confirms the extent to which innovative countries are investing in R&D activity. On the other hand, the analysis of innovation for all concerned European countries, shows a great difference. This country diversity reveal that each member state development level is strongly connected with the distribution of enterprises, which put a lot of expense on innovational activity. The countries, especially the poorer ones could bind the ability of its development with enterprises which are located in this country.

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