THE IMPACT OF INNOVATION ON COMPETITIVENESS OF THE EUROPEAN UNION MEMBER STATES

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Abstract

Innovation is one of the most important aspects of knowledge-based economy. It is a catalyst for development and economic growth of Member States. Despite of European Union efforts in terms of cohesion policy, Member States are diversified in the area of economic development. Therefore, they have a different approach to innovation policy and innovation growth. Bearing in mind these discrepancies, it is reasonable to study and monitor this matter continuously. Thus, the key objective of this article is to measure innovation in the EU Member States. The work contains the characteristics of innovation and competitiveness. The statistical analysis was used as a research method for the implementation of the chosen objective**.**

The article consists of two main parts, theoretical and empirical. In the first part, the concepts of innovativeness and competitiveness were defined. In the second one, the results of statistical analysis were presented. The data concerning 8 selected factors, which characterize 28 European Union Member States, was used to classify Member States into 4 groups in terms of level of innovativeness: best, good, weak, and the weakest countries. The analysis is based on Eurostat data. The reference year is 2015.

Key words: innovation, competitiveness, measurement of innovation, European Union countries

JEL Code: F63, O11, O31.

Introduction

Both theory and empirical research indicate a close connection of innovation with the countries competitiveness. Therefore, it is important to base economic development on

innovative technologies that will allow to increase productivity and improve the quality of products while reducing production costs.

Innovation is widely regarded as a key factor for the development and building of competitive advantage of modern economy. The experience of EU countries indicates that only economies, that can create and disseminate innovations, are successful. Promotion and support of innovative activities of Member States are considered by the European Commission (EC) to be one of the priority objectives of economic policy.

The key objective of the work was to measure innovation in the EU Member States. The statistical analysis turned out to be an indispensable research method in the implementation of the chosen objective. Data on eight selected innovation indicators characterizing twenty-eight the EU Member States were used. The year of 2015 was adopted as the research period. The statistical data was taken from the Eurostat database.

1 Characteristics of the concept of "innovation"

It is believed that the concept of "innovation" was introduced by Joseph Schumpeter in the 1930s. He claimed that innovation has much more impact on economic development than capital. By innovating, he meant introducing a new product into the market, using a new production method, finding a new market for existing products, acquiring and developing new sources of raw materials or using a new type of raw materials, as well as introducing organizational changes in the company (Wolak-Tuzimek, 2016, pp. 2058-2059).

Four types of innovations are common in business practice (Ambarova, Zborovsky, 2015, p. 34):

- technological/technical innovations are considered the most important, because they bring the highest added value and the highest income of the entrepreneur, but they are also the most expensive. They contribute to the development of products and services. They are based on the results of scientific works and research activities. This type of innovation is often a source of organizational and process innovations;
- organizational innovations involve a change in the way the company functions, change of work organization, or management organization. They are often costless and are related to the rationalization of the organization or its adaptation to the changing legal regulations or requirements of the customers;

- process innovations are very often linked to the introduction of technical innovations. They concern the introduction of changes in the production process or the providing services process;
- marketing innovations concern the sphere of sales and distribution of finished products and services. These are, for example, new packaging, new forms of advertising, or new pricing strategies.

Often, all types of innovations occur together, especially in manufacturing enterprises (manufacturing of new products). In service enterprises, mostly organizational and marketing innovations are applied (Brożek, Kogut, 2016, pp. 46-47).

According to P.F. Drucker: "An enterprise without innovations inevitably ages and declines. In the period of rapid changes in the entrepreneurial period, such as today - the fall will be fast. (...) Innovation is a specific entrepreneurial tool - an activity that gives resources new opportunities to create wealth" (Wolak-Tuzimek, et al., 2015, p. 55).

Innovations are a resource that we usually reach only when other resources, that are easier to manage, are exhausted. However, many modern enterprises conduct innovative activities even sacrificing current benefits to them (in the hope that these actions will give a much better result in the future) (Lament, 2016, p. 1033).

Innovations are becoming more and more important from the point of view of the competitiveness of the economy. That is why the European Union strongly supports innovation from its funds (Kogut, Brożek, 2016, pp. 26-27).

2 Characteristics of the concept of "competitiveness"

The term "competition" comes from the Latin term "concurrere", which means "to run together". However, the substantive meaning of this concept is different and is explained as competition between rivals. It occurs in many areas of social, economic, political, cultural, artistic, or sporting life. Competition is treated as a phenomenon that characterizes certain types of relationships between entities that have been covered by this phenomenon. These relations simply consist of competing. To compete effectively, you have to be competitive and strive to achieve the set goals (Wiśniewska, 2012, p. 9).

In the literature on the subject, the concept of competitiveness is differently defined by different authors. One definition of competitiveness is the ability to effectively oppose the competition. The author believes that it concerns both the level of enterprises and national economies. According to another definition, competitiveness is the ability to achieve long-

term, effective growth. By nature, the effectiveness, dynamism, and flexibility of the business entity under study are its elements (Dyr, Ziółkowska, 2014a, p. 6).

When considering the level of competitiveness of regions, a lot of attention is usually attached to the economic strength. It is determined on the basis of the size of public revenues created in the regions. It is widely believed that the competitiveness of regions is affected by (Góralski, Lazarek, 2009, pp. 307):

1. Diversification of their economic structures.
2. Transport accessibility.
3. Existence of scientific and research facilities.
4. Existence of a business environment.

These characteristics foster the development of entrepreneurship, their shortage and weaknesses of the overall level of development leave the region in a position less attractive in relation to other regions (Marakova, et al., 2016, pp. 92-93).

Among the factors realistically existing in the regions that determine the construction of their competitive potential, the following factors are distinguished (Góralski, Lazarek, 2009, pp. 310):

1. Diversified structure of the economy, including branches and enterprises capable of competing in the processes of international production and exchange.
2. Investments – domestic and foreign, public and private.
3. Technical infrastructure – efficient transport system, telecommunications, water supply, electricity, etc.
4. Social infrastructure – education system, health care, social welfare, etc. (see Dyr, Ziółkowska, 2014b, pp. 8-9).
5. Research and development activity – scientific and research institutions.
6. Research and development units, universities, etc.
7. Environmental resources.
8. Business-related institutions – local development agencies, chambers of commerce, delivery funds, etc. (see Bednarczyk, 2010, pp. 10-15).

3 Methodology of the research

Two key areas were taken into account in the measurement of innovation. The first of them is Science, Technology, and Innovation, while the second is Digital Economy and Society. Four

selected innovation indicators were chosen for each of these areas. The distribution of variables is presented in Table 1.

Tab. 1: Innovation indicators

Area	Indicators
Science, Technology, and Innovation	R&D – Total expenditure on research and development (GERD) by performance sectors per 1000 people
	Z – Employment in technologies and sectors requiring high knowledge at the national level by gender per 1000 people
	B – Unemployed persons by category and gender HRST per 1000 persons
	P – Patent applications to EPO according to the priority year per 1000 people
Digital Economy and Society	G – Households - Internet access level (%)
	A – Enterprises with broadband access (%)
	O – People who have basic or above basic digital skills by gender (%)
	H – Digital Single Market - promoting e-commerce for individuals (%)

Source: own study.

It should be noted that among the selected eight indicators, seven are stimulants while only one is a destimulant, namely: B – Unemployed persons by category and gender HRST per 1000 persons. The first group of indicators has been unified by adopting the value per 1000 persons, while the second group is a percentage.

The analysis was divided into several stages. The arithmetic mean, standard deviation, a or the coefficient of variation, and maximum and minimum values were calculated first. Then, on the basis of the obtained calculations, they were standardized and the Euclidean value and the synthetic meter were calculated.

3.1 Research result

The maximum standardized values were selected for all selected innovation indicators. A detailed distribution is presented in Table 2.

Tab. 1: The maximum and minimum standardized values

Area	Indicators	Maximum	Minimum
Science, Technology and Innovations	R&D –Total expenditure on research and development (GERD) by performance sectors per 1000 people	Sweden	Romania
	Z – Employment in technologies and sectors requiring high knowledge at the national level by gender per 1000 people	Sweden	Greece
	B – Unemployed persons by category and gender HRST per 1000 persons	Malta	Greece
	P – Patent applications to EPO according to the priority year per 1000 people	Sweden	Croatia, Romania
Digital Economy and Society	G – Households – level of Internet access (%)	Luxembourg	Bulgaria
	A – Enterprises with broadband access (%)	Latvia, the Netherlands, Finland	Bulgaria
	O – People who have basic or above basic digital skills by gender (%)	Luxembourg	Romania
	H – Digital Single Market - promoting e-commerce for individuals (%)	Great Britain	Romania

Source: own study.

Among countries with maximum values for the first research area (that is, Science, Technology, and Innovation), Sweden was definitely ahead as the best results were obtained in the three analyzed indicators. An interesting fact is that in the case of analyzing destimulants, Malta achieved the best result.

On the other hand, in the second analyzed area (Digital Economy and Society), Luxembourg should be distinguished, because it obtained the highest result for two indicators,

followed by the United Kingdom, while for one stimulator as many as three countries recorded the maximum standardized values. Among them were Latvia, the Netherlands, and Finland.

After analyzing the maximum values, it was decided to examine also the minimum standardized values. In the area of Science, Technology, and Innovation the worst performers were two countries, Greece and Romania, because they obtained minimum standardized values for two indicators. Also, Croatia was in this group. However, when analyzing the area of the Digital Economy and Society, it should be noted that Romania again was the worst one, while Bulgaria took the place of Greece in this case.

The next step in the analysis was to take the following five steps:

- sorting by decreasing measure M;
- determining the mean value;
- division into two groups, depending on whether it is smaller or larger than the average value;
- determining the averages for each group m1 and m2;
- division into four groups designated by three averages.

The effect of their implementation was the division of countries by the level of innovation into four groups, respectively: best, good, weak, and the weakest countries. So also in the first area – Science, Technology, and Innovation – the following ranking of EU countries was obtained – Table 3.

Tab. 3: Division of countries due to the level of innovation in the area of Science, Technology, and Innovation and Digital Economy and Society.

Science, Technology and Innovations			**Digital Economy and Society**		
1. Sweden	0.8493384	Best	1. Great Britain	1	Best
2. Germany	0.83651471		2. Germany	0.9241	
3. Denmark	0.79758468		3. Sweden	0.8793	
4. Austria	0.79074408		4. Denmark	0.8492	
5. Netherlands	0.69197828		5. Netherlands	0.8126	
6. Finland	0.68789278		6. Finland	0.7985	
7. Luxembourg	0.61059494	Good	7. Estonia	0.7863	
8. Great Britain	0.54963373		8. Austria	0.7598	

9. Belgium	0.51695686		9. Luxembourg	0.732	
10. France	0.46409867		10. Belgium	0.7125	
11. Ireland	0.44355411		11. Malta	0.6382	
12. Slovenia	0.43473162		12. Slovakia	0.6234	Good
13. Czech Republic	0.42464874		13. France	0.6083	
14. Estonia	0.39455438		14. Czech Republic	0.6077	
15. Lithuania	0.35402705		15. Ireland	0.5745	
16. Latvia	0.35362755		16. Spain	0.5683	
17. Slovakia	0.35308313		17. Slovenia	0.5179	
18. Hungary	0.34875388	Weak	18. Lithuania	0.5007	
19. Malta	0.34754361		19. Hungary	0.4525	
20. Portugal	0.32508372		20. Portugal	0.4193	Weak
21. Poland	0.32236519		21. Latvia	0.4183	
22. Italy	0.31896655		22. Croatia	0.4104	
23. Romania	0.31095679		23. Poland	0.4097	
24. Bulgaria	0.30160355		24. Italy	0.3627	
25. Croatia	0.21246173		25. Cyprus	0.3298	
26. Spain	0.15088879		26. Greece	0.2845	
27. Cyprus	0.1347539	Weakest	27. Romania	0.0293	Weakest
28. Greece	-0.01693623		28. Bulgaria	-0.0844	

Source: own study.

After an in-depth analysis, it should be noted that the six most innovative EU Member States include: Sweden, Germany, Denmark, Austria, the Netherlands, and Finland. Luxembourg, the United Kingdom, Belgium, France, and Ireland also performed well. The most numerous group turned out to be the one concerning weak innovators. It included thirteen countries, including Poland. However, Croatia, Spain, and Cyprus were the weakest countries in terms of the level of innovation in the research area, and the last place belonged to Greece.

Great Britain was best in the second area (Digital Economy and Society), however, the following countries ranked in the next places: Germany, Sweden, Denmark, the Netherlands, Finland, Estonia, and Austria. The second group included these countries: Luxembourg, Belgium, Malta, Slovakia, France, the Czech Republic, and Ireland. The average countries

were Spain, Slovenia, Lithuania, Hungary, Portugal, Latvia, Croatia, Italy, and again also Poland. Without surprise, the weakest level of innovation was recorded in four countries, namely Cyprus, Greece, Romania, and Bulgaria.

Conclusion

In developed market economy, business entities and regions compete for development factors, which allow to gain permanent competitive advantage. One of the most important factors of regional development is innovativeness. Regions striving for improvement of innovativeness level, make a choice of the way they gain innovations.

An analysis of factors responsible for innovativeness the level, revealed a large differentiation among the EU Member States. Taking into account two considered areas, in 2015, Sweden and Germany were characterized by the highest level of innovativeness among the EU Member States. Both countries have ranked within top three of best innovators in EU. This indicates high level of investments in R & D sector in these countries, employment in technologies and sectors requiring high knowledge at the national level and number of applied patents. Aside from high level of developments in science, technology and innovation, these countries are characterized by high level of digitisation of economy and society.

Also, Denmark followed by the United Kingdom, was on the podium. By contrast, Greece had the poorest position, but also Bulgaria and Cyprus got a very poor result, with Romania slightly better. In Poland, an increase in innovativeness is noticeable, however it is far away from the top. To boost the level of competitiveness, Poland and other countries identified in the analysis as weak and weakest, should improve their the level of innovativeness.

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