EMPIRICAL EVIDENCES REGARDING THE ROLE OF INNOVATION IN ECONOMIC GROWTH

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Abstract

Innovation is the main market trigger that generates economic growth and development. Although studies in the field have pointed out numerous benefits that innovation brought to its creators and end consumers, not all companies manage to innovate. This paper aims to evaluate the impact of innovation upon economic growth, by computing the various indicators used to evaluate the management potential of innovation, the potential to create knowledge, the potential to innovate and collaborate, the performance of innovation activities and the level of economic development per country. The study was performed on the 27 European countries (excluding Luxemburg), using the information available in Eurostat statistics for the period 2008 – 2014. In order to find an answer to the research problem, this paper used the following data analysis methods: the ratios method, the correlation analysis, the comparative analysis. The results showed that there is a strong, direct, and measurable link between a country's level of economic development and its innovation ability, and the performance of innovation activities is influenced by their funding source (public or private capital).

Key words: innovation, economic growth, research and development

Under the current economic conditions, at the basis of economic growth and development lies change. Innovation is the most important means to economic growth and development and for improving global business performance, especially on the long term (Ionescu, 2015). Innovation in itself does not trigger economic growth and development, but it determines technical progress. By designing new technologies, information is created, which then becomes ever more valuable as it is more often used by entrepreneurs. The latter, through their entrepreneurial ability to capitalize upon the information and to obtain new economic products and services, favour economic growth and development.

Governments turn innovation into a key element in the current political agenda, acknowledging its contribution to economic growth and to eliminating the present social and environmental problems. Nevertheless, in many member states of the European Union, several gaps can be noticed in this field as a result of the numerous constraints in place.

Using the statistical data provided by Eurostat and the European Commission, this paper is looking for answers to the following questions:

- What are the key indicators that determine the success of the innovation process at a country level?

- What is the funding structure of RDI activities – under a public/ private aspect – that determines the best performance?

MATERIAL AND METHOD

The study was performed on 27 European countries, using the information available in Eurostat statistics for the period 2008 – 2014, resulting in 135 observations. The analysis excluded Luxembourg, since it was an extreme compared to the majority of the variables included in the study.

In order to answer the research problem, this paper used the following data analysis methods: the ratios method, the correlation analysis, and the comparative analysis.

In close connection with the research objectives, we selected the independent variables (*table 1*) that can best express the influence on the indicators variation: GDP per 100,000 inhabitants and Net annual income per inhabitant

The indicators in Table 1 were computed for the 27 EU member states (excluding Luxembourg) for a five-year period (Year 1 – Year 5). Considering the dependent variables *GDP per 100,000 inhabitants* and *Net annual income per inhabitant*, we analysed the effect of the triggers (categories 1 – 3, 4.2, 4.4 – 4.6) on them.

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Table 1

Indicators that evaluate innovation and economic development

Category	Indicator	Symbol
1. Innovation management potential	1.1 Weight of the research and development staff in the total employed population (%)	Ppc
	1.2 Weight of the population with higher education or involved in research activities in the total active population (%)	Psup
2. Knowledge generation potential	2.1 Weight of the R&D expenses in the national GDP (%)	Pcd
	2.2 Weight of the expenses for the staff employed in research in the total R&D expenses (%)	Pcfm
	2.3 Weight of the investment expenses in the total R&D expenses (%)	Pcfix
	2.4 Weight of the expenses from public sources in the total R&D expenses (%)	Ppub
	2.5 Weight of the expenses from private sources in the total R&D expenses (%)	Ppriv
3. The performance of innovation activities	3.1 The eco-innovation index (EU27=100)	Ecoinv
	3.2 The number of RDI results (patents, products, brands, studies, etc.) per 100,000 inhabitants	Nrez
	3.3 Weight of the staff employed in industries based on high technology (%)	Ptech
	3.4 Energetic intensity (kg equivalent oil / 1,000 euro GDP)	Energ
4. Level of economic development	4.1 GDP mil. euro/ 100,000 inhabitants	GDP
	4.2 Weight of the employed population in the total active population (%)	Pocup
	4.3 Net annual income per inhabitant (100=EU27)	Vnet
	4.4 Hourly work productivity (euro/ hour)	Wh
	4.5 Weight of the persons with a risk of poverty and social exclusion in total population (%)	Ppov
	4.6 Weight of the households with Internet access (%)	Pnet

Source: ANCS – Guide for assessing the impact of innovation and technological transfer in an economic and social context. Own contributions

RESULTS AND DISCUSSIONS

The gross domestic product per capita for the European Union has a mean value of 22,724 euro/ year, with a square mean deviation of 12,029 euro/ year, for the analysed period. The fact that the mean deviation is over 50% of the average value of the GDP per capita indicates the existence of an important economic disparity between EU countries, which does not surprise us. We can notice in Figure 2 that Denmark is the highest extreme in what concerns the value of the GDP per capita and Bulgaria has the lowest value for this indicator. Standard deviations that are very high compared to the average (over 50%) are also visible for the indicators that characterise the innovation potential, respectively R&D expenses in the national GDP (60%) and the number of RDI results (patents, brands, studies, etc.) per 100,000 inhabitants (78%). These results indicate the existence of powerful countries that reach high levels of economic development, in the context of innovation ability considerably above the mean for the EU. The category of these countries includes Denmark, Sweden, Finland and the Netherlands, and in the Innovation Union Scoreboard they are called leading innovators. Allocating over 3% of their GDP to the research and development field allows these states to compete with world leaders in innovation, respectively the USA, Japan and South Korea.

The smallest differences between EU countries can be noticed for the indicator corresponding to the work force: the weight of the employed population in total active population (5%), the weight of the expenses for the staff employed in research in total R&D expenses (18%) and the weight of the population with academic studies or involved in research in total active population (19%). It results that these indicators have a relatively weak influence on the economic growth indicator.

The results of the correlation analysis were synthesized in *table 2*.

Pearson's correlation coefficients (r) presented in Table 2 indicate the existence of a very strong link in Option 1 between the dependent variable GDP and the following independent variables: hourly work productivity (+0.978), the number of RDI results (+0.853), the eco-innovation index (+0.796), the weight of the R&D staff in total employed population (+0.772) and the weight of the R&D expenses in the national GDP (+0.763). The significant intensity of the link between these indicators is supported by the Sig. values under 0.01 obtained according to the *T student test*.

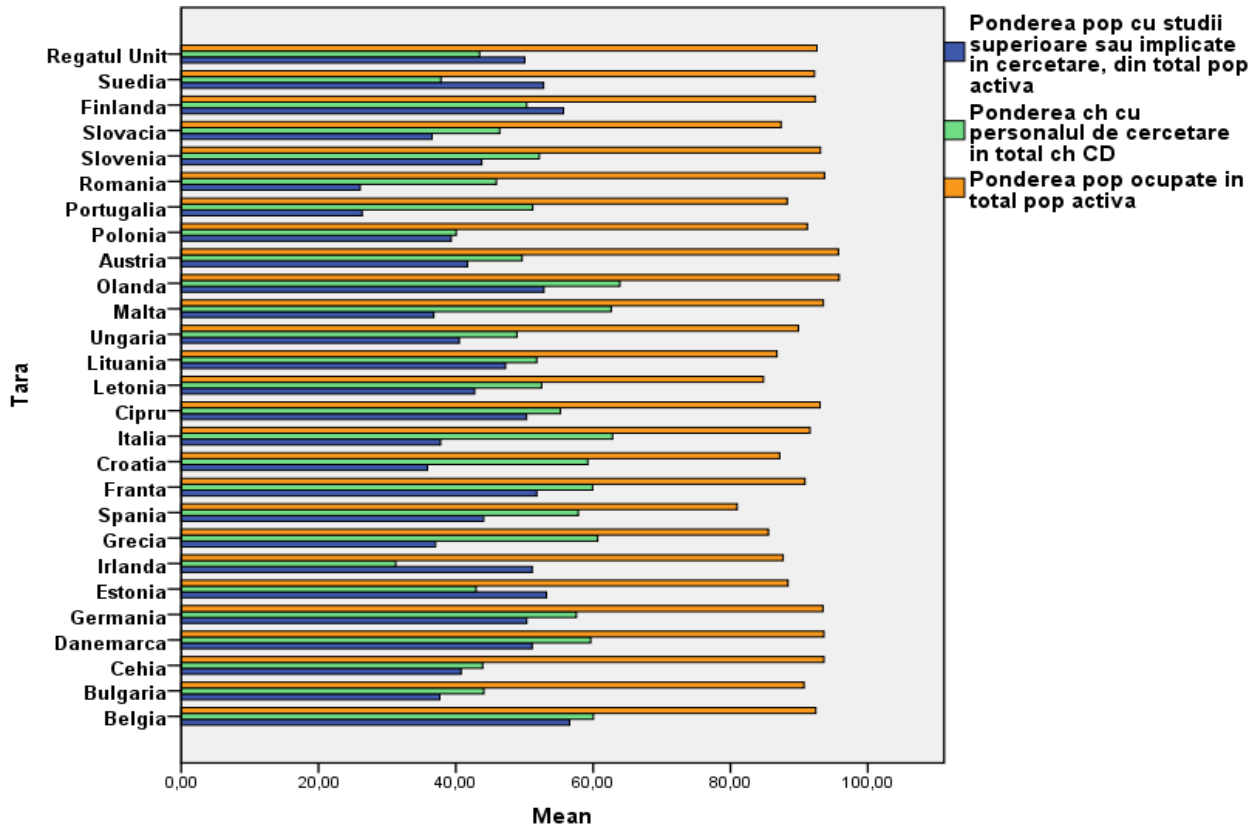

Figure 1 **Workforce indicators (mean for the period 2008 – 2012)**

Analysing the way in which the source of capitals for research and development influences the GDP level, we can notice a moderate reverse relationship between the weight of the expenses from public sources in the total R&D expenses and the GDP level (r = -0.683). In exchange, the link between the weight of the expenses from private sources and the GDP level is direct (r =0.682). From the two relations, there results that triggering private resources for the research and development activities is the path to improving a country's development. These results are in agreement with the objectives that the European Union has to meet by 2020, respectively private-source investments in research and development to a minimum percentage of 1.5% of the GDP.

In most of the analysed countries, a high level of the gross domestic product per capita is accompanied by a higher weight of the private expenses with R&D activities. Thus, the countries that invest in research and development from mainly private sources (over 50%) are leading innovators of the European Union – respectively Finland (67.87%), Germany (66.45%), Denmark (64.96%) and Sweden (60.02%). These countries also report the highest levels of economic development, according to the GDP/inhabitant indicator. A more special situation can be seen in the case of Cyprus, which allocates a very low percentage of private funds to R&D activities – only 14.19% of the total R&D expenses, but reports an innovation performance level above the EU average.

CONCLUSIONS

The results of our research demonstrate that innovational success at a country level is influenced by the increase of the weight of the research and development expenses in the national GDP, with a main provenience (over 50%) from private sources of the business world. Thus, the countries that invest in research and development to a percentage of over 60% from private sources are leading innovators in the European Union, respectively Finland, Germany, Denmark, and Sweden.

These countries also report the highest levels of economic development, according to the GDP per capita indicator. Considering the results obtained, we can say that the performance of innovative activities is influence by the ratio public funding / private funding.

In order to fulfil the objectives of the Europa 2020 Strategy concerning spending over 3% of the GDP for R&D activities, the states should stimulate private companies in this direction, facilitating the access to the financial resources needed to implement innovative projects, by granting fiscal facilities and my publicising the

positive impact of RDI activities on economic growth.

Table 2

Testing the correlation between the variables

		Option 1	Option 2
		LnGDP	LnIncome
Ppc	Pearson Correlation	,772**	,698**
	Sig. (2-tailed)	,000	,000
Psup	Pearson Correlation	,646**	,590**
	Sig. (2-tailed)	,000	,000
Ptech	Pearson Correlation	,556**	,510**
	Sig. (2-tailed)	,000	,000
Pcfm	Pearson Correlation	,175*	,246**
	Sig. (2-tailed)	,043	,004
Pocup	Pearson Correlation	,268**	,263**
	Sig. (2-tailed)	,002	,002
Pnet	Pearson Correlation	,740**	,665**
	Sig. (2-tailed)	,000	,000
LnPcd	Pearson Correlation	,763**	,687**
	Sig. (2-tailed)	,000	,000
LnPcfix	Pearson Correlation	-,447**	-,445**
	Sig. (2-tailed)	,000	,000
LnNrez	Pearson Correlation	,853**	,831**
	Sig. (2-tailed)	,000	,000
LnGDP	Pearson Correlation	1	,975**
	Sig. (2-tailed)		,000
LnEnerg	Pearson Correlation	-,841**	-,874**
	Sig. (2-tailed)	,000	,000
LnEcoinv	Pearson Correlation	,796**	,754**
	Sig. (2-tailed)	,000	,000
LnPsarac	Pearson Correlation	-,753**	-,722**
	Sig. (2-tailed)	,000	,000
LnIncome	Pearson Correlation	,975**	1
	Sig. (2-tailed)	,000	
LnWh	Pearson Correlation	,978**	,974**
	Sig. (2-tailed)	,000	,000
Ppub	Pearson Correlation	-,683**	-,638**
	Sig. (2-tailed)	,000	,000
Ppriv	Pearson Correlation	,682**	,638**
	Sig. (2-tailed)	,000	,000
**. Correlation is significant at the 0.01 level (2-tailed).			
*. Correlation is significant at the 0.05 level (2-tailed).			
N – 135			

From the analysis performed on EU member states, there resulted the existence of strong countries that reach high levels of economic development in the context of an innovation ability significantly above the EU average (Denmark, Sweden, Finland, etc.). Allocating over 3% of the GDP to the research and development sector allows these countries to compete with world leaders in the field of innovation, respectively the USA, Japan, and South Korea.

From the research conducted it appeared that there is a direct and measurable strong bond between the level of economic development of a country and its innovative capacity, respectively the role of innovation in economic growth is very important.

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