THE DYNAMICS OF R&D ACTIVITIES IN ROMANIA
WITHIN THE EUROPEAN CONTEXT

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ABSTRACT

This study examines the evolution of R&D activities in Romania through a complex structural analisys. By linking the R&D intensity and the level of economic development, we came with a new clasification of states in the EU, thus generating a framework for a pragmatic analisys of the Romania's situation in the European contex. Also, we studied the dynamics of the R&D activities in Romania over the 2005-2010 period in a comprehensive structural approach (types of research, sectors of performance, funding), focusing on the way this tendancies are helping Romania's real convergence to the EU average. In our attempt to tackle the root causes of the deficiences we have identified, the analisys went forward, approaching the isues of cooperation and colaboration of SMEs in performing R&D activities. In order to catch up, Romania has to invest masively in R&D, because, as the new economy emerges – the knowledge-based economy – the sources and resources for future developments will fundamentaly rely on the capacity of organisations, and the society as a whole, to generate knowledge with economic value. Our results ephasize that the economic development and wealth creation are positively correlated with the amount of gross R&D expenses, thus underlineing that in order to stimulate the overall R&D activities, the prior actions must adress the private sectors. Also, the governmental intentives should target the needs and characteristics of SMEs.

KEYWORDS: *Knowledge-based economy, European Union, R&D, SMEs*

JEL CLASSIFICATION: *L29, O11, O30, O52*

1. INTRODUCTION

Emerging trends at global level emphasize the increasing importance of knowledge for productivity growth and economic development, this being one of the premises that are implied by the new economic paradigm – the knowledge-based economy. A comprehensive definition of this new approach states *"that knowledge-based economy is characterized by the transformation of knowledge in raw material, capital, products, essential production factor for the economy, and by economic processes in which the generation, selling, acquisition, learning, stocking, developing, splitting and protection of the knowledge become predominant and decisive for long term profit gaining and sustainability assurance"* (Nicolescu, 2011). As R&D contribute decisively to the creation of new knowledge and economic performance improvement, the new economic environment imposes the necessity of R&D stimulation as a strategic priority.

The strategic approach of the European Union (EU 2020) recognizes the importance these evolutions, aiming to become a *"smart, sustainable and inclusive economy"*. As a result, 2 of the 3 priorities (becoming a smart and sustainable economy), 2 of the 5 major objectives (R&D and climate change/energy) and 3 of the 7 flagship initiatives (Innovation Union, Resource efficient Europe, An industrial policy for the globalization era), are involving an essential contribution from R&D activities.

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Having the above mentioned elements, it is important to highlight that this study will focus on the identification of the most relevant tendencies regarding R&D activities in Romania from the perspective of structural changes over a six year period.

2. THEORETICAL FRAMEWORK

The theoretical literature on R&D is emphasizing the substantial growth of R&D activities carried out as a result of collaboration through networks (Kesavayuth, 2012). In fact, there is clear evidence that the scale of the funding involved by the R&D projects has a great influence on the innovation output (Schwartz, 2012), that is why stimulating collaboration through R&D consortiums, networks, clusters etc. is a must from a policy-making perspective.

The investigation of the relationship between corporate governance and investment in R&D, points out that in order to *"enhance companies' innovation and R&D capabilities, they need to improve their corporate governance"* (Dong, 2010). A more detailed research regarding the impact of the management characteristics on the R&D activities, is emphasizing the following: *"(1) the presence of CEO incentive schemes increases both corporate innovation effort and innovation performance; (2) sales-based performance measure in the incentive scheme, as compared with profit-based performance measure, is more conducive to firm innovation; and (3) CEO education level, professional background and political connection are positively associated with firm's innovation efforts"* (Lin, 2011). As an intuitive continuation, the conclusions of some authors suggest that the main actions, in order to stimulate R&D activities, should focus on the SMEs management improvement and the encouragement of R&D cooperation (Martinez-Roman, 2011). The theoretical literature is highlighting that *"the perspective on managing R&D processes has changed over the years, moving from a technology-centered model to a more interaction-focused view"* (Nobelius, 2004).

The major concern that the theoretical framework emphasizes, i.e. the possibility that *"public R&D subsidies crowd out private R&D investment"*, is invalidated by empirical data, as a general rule, there is evidence that *"funded firms are significantly more R&D active than non-funded firms"* (Aerts, 2008). There are authors that investigate the issue of R&D activities in a wider perspective, focusing on export stimulation and competitiveness growth of enterprises in general, and especially SMEs (Esteve-Perez, 2012).

3. METHODOLOGY

This study of ours is based on the statistical data series regarding R&D for the EU27 economies and especially Romanian economy, data sources used being mainly the Eurostat database, "The Community Innovation Survey" and "Romanian Statistical Yearbook". The data from these publications is centralized and structured as dynamic series, making therefore possible for the analysis process to emphasize the main tendencies. The definitions used in this study are the ones proposed by OECD, and adopted by both Eurostat and the Romanian National Institute of Statistics. So, the research and experimental development (R&D) *"comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications"*.

In order to examine the European context, we have studied the correlations between: (1) the level of economic development (GDP per capita) and the amount of gross R&D expenses as percentage of GDP (GERD); and (2) the GERD and the intensity of extra-governmental R&D expenses (the ratio between the shares of R&D expenses financed from extra-governmental funds and the ones from governmental sources). Making the general approach more complex, we also analyzed the Romanian R&D in a structural and dynamic paradigm. The structural approach focused on the types of R&D activities (fundamental research, applied research and experimental development), sources of funds, sectors of performance and enterprise size (SMEs vs. Large enterprises). The dynamic

component materialized in determining the total change and the average annual growth/decrease rates, in real terms, for the structural components mentioned above. The period taken into account is 2005-2010, this being the most recent data available.

The study continues with the conclusions implied by our results, determining in the end some vital measures that have to be taken in order to improve the current situation, and make the Romania's real convergence more feasible and rapid.

4. RESULTS

4.1 R&D activities in the EU

The level of economic development (GDP per capita) is positively correlated with the amount of gross R&D expenses as percentage of GDP (GERD), this being supported by both theoretical and empirical research. In the European Union, as it is shown in Figure 1, can be distinguished three main groups of states, that differ one from another not only in terms of size, but also structure: (1) states with high R&D level (Finland, Sweden, Denmark, Germany and Austria); (2) medium R&D level (France, Slovenia, Belgium, Netherlands, Ireland, Great Britain, Estonia, Portugal, Czech Republic, Spain and Italy); and (3) low R&D level (Hungary, Lithuania, Poland, Malta, Slovakia, Bulgaria, Latvia, Cyprus and Romania).
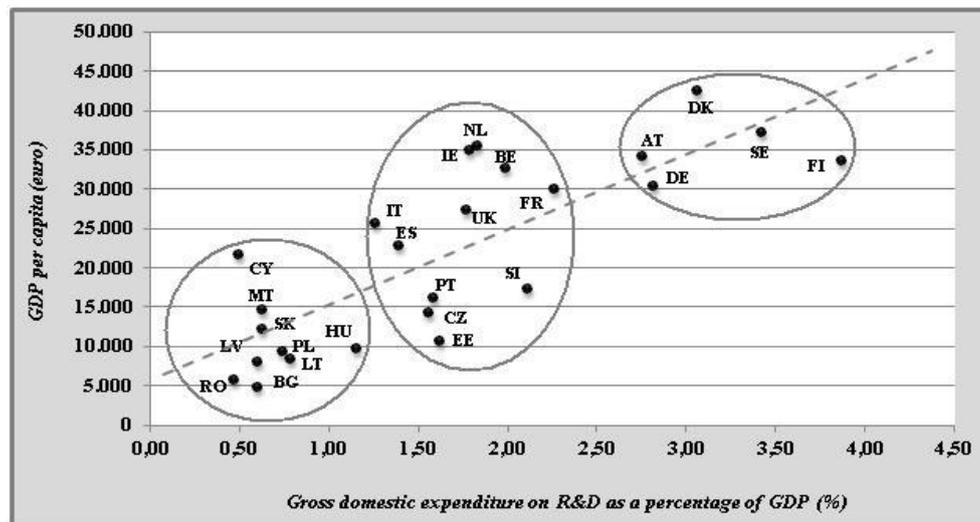

Figure 1. GDP per capita and GERD correlation in EU
Source: Eurostat data, own calculations

This classification emphasizes that there are cultural, geographical and historical premises that led to such a distribution. So, the Eastern border of EU consists of almost only states with low R&D level and low GDP per capita; the high performers in terms of R&D are states of Germanic origin and influence; and the rest, the medium category, consists mainly of Latin and Anglo-Saxon origin. Another historical argument points out that the countries that over time were known as great possessors of colonies, are not the most successful in terms of wealth creation (GDP per capita) and R&D intensity, the root cause of this lies in the reflexes that remained after a period when the paradigm of economic development was based on an extensive approach.

The ratio between the shares of R&D expenses financed from extra-governmental funds (enterprises, higher education, private non-profit and abroad) and the ones from governmental sources, is a proxy for measuring the intensity of extra-governmental participation to R&D activities. If we analyze this indicator at EU level, the results are leading to the conclusion that there is a clear positive correlation between the GERD and the intensity of extra-governmental R&D

expenses (see Figure 2), this finding suggesting that in order to stimulate the overall R&D activities, the prior actions must address the private sector.
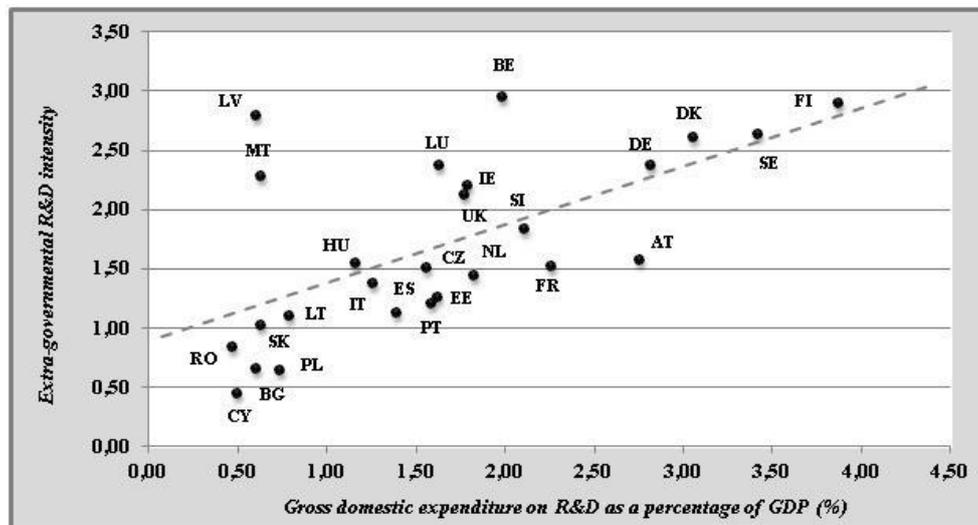
Figure 2. Extra-governmental R&D intensity and GERD correlation in EU
Source: Eurostat data, own calculations

4.2 R&D activities in the Romanian economy

In 2010, Romania had a GERD level of almost 4,3 times smaller (0,47% of GDP) then the one from EU27 (2,00% of GDP), which translates in a divergent evolution that widens the economic development gap. The situation looks really bad if we link the R&D gross expenses to the total number of population, Romania scoring a 26,7 euro per inhabitant − 18,3 times less than the average level in EU (490,2 Euro per capita). Although there are few arguments for being optimistic, there is a significant improvement over the last eight years, in 2003, Romania had the R&D gross expenses per capita 41,6 times lower than the EU average. Our analysis emphasizes also that the structure of these expenses are only 32,3% financed by the enterprise sector, the main causes being the undercapitalization of Romanian enterprises and the lack of governmental incentive schemes for performing R&D activities.

Although there is clear evidence that the R&D expenses that must be stimulated are the ones from the private sector, in Romania, during the 2005-2010 period, R&D activities financed from governmental funds increased aprox. 2,5 times faster than those financed by the enterprise sector (an average annual rate in real terms of 5,34%, comparative to a 2,03% rate). The highest average annual rate was recorded for the R&D that is financed from external/abroad sources (21,98%). Also, the governmental funds decreased in volume for the enterprise performance sector at an annual rate of 4,30%, at the same time raising for the higher education (an average annual rate of 23,29%) and governmental (an average annual rate of 3,75%) performance sectors. The R&D activities that are carried out in the enterprise performance sector, and are financed by the enterprise sector, remained almost the same in real terms. The above mentioned changes are generating a negative impact because of the structure of the current expenditure from R&D activity by sector of performance and type of research (see Figure 3).
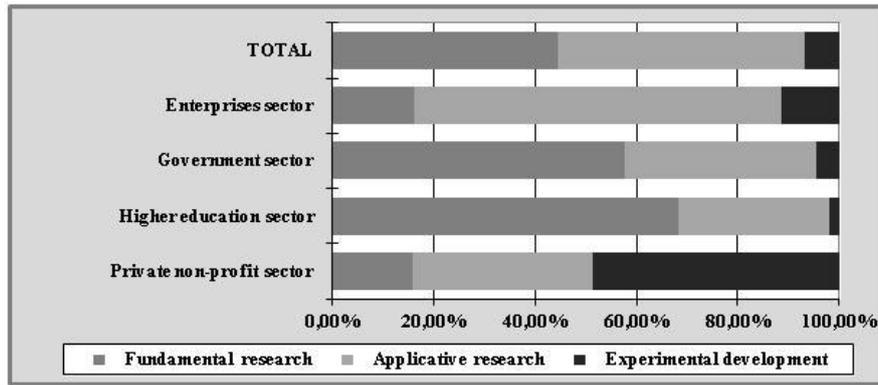
Figure 3.   Current expenditure from R&D activity by sector of performance and type of research
Source: Eurostat data, own calculations

So, the enterprise sector is performing applied research (72,21%) in a much larger extent than the governmental and higher education sectors (37,77%, respectively 29,93%). Also, if we analyze the dynamics of the current expenditure from R&D activity, the results are suggesting a deterioration in terms of structure, pointing out that the fundamental research share almost doubled over the 2005-2010 period (from 23,89% to 44,64%, meaning a 20,75 percentage points growth), in contrast to the share of applied research (a decrease of 16,76 p.p., down to 48,63%) and experimental development (a decrease of 3,99 p.p., down to 6,72%). This transformation is explained by the variation in real terms of the amount spent on these categories of current R&D expenditure. Our calculation shows that over the 2005-2010 period, the fundamental research rose in value by 129% (at an average annual growth rate of 18,10%), applied research decreased by 8,55% (at an average annual rate of 1,77%), and experimental development reduced its amount in real terms by 22,85% (at an average annual rate of 5,06%). What is important to mention about this situation is that, as it is shown in Figure 4, where (according to the classification from the previous chapter) we present the first and the last states from each category (except the low R&D level category, which is represented only by Romania), the more developed an economy is (in terms of GDP per capita and R&D intensity), the more intense are the experimental development and applied research. Such a trend could be explained by the speed and intensity an R&D result is generating revenue. So, the results obtained by fundamental research, in order to generate economic wealth, have to be transposed in a more applicable way, and after that, it is the stage where the prototype building is the critical one. In other words, applied research is a more advanced step in exploiting a fundamental finding, experimental development being the stage where the new product, service or process is actually built, tested and operationalized.
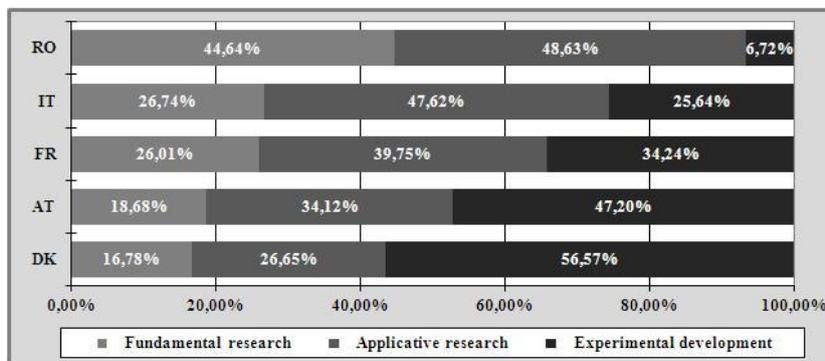

Figure 4.   Current expenditure from R&D activity in the EU by type of research
Source: Eurostat data, own calculations

Going to a more detailed approach of R&D activities, our study captures some tendencies and perspective regarding the SMEs sector. So, there is a positive correlation between the enterprise size and the propensity to innovate, but if we analyze it more profoundly, the SMEs are more likely to carry out R&D activities. The Community Innovation Survey data reveals that enterprise size is negatively correlated to: (1) the share of R&D in the total expenses regarding technological innovation; and (2) the R&D activities that are performed internally. This finding emphasizes that, in order to stimulate the R&D activities, the governmental incentives in Romania should target the needs and characteristics of SMEs. The propensity to cooperate is positively correlated to the size of the enterprises, thus SMEs are cooperating less. Also, as the organizations get bigger, the innovational processes become more complex, containing both technological and non-technological (organizational and marketing) innovation.

5. CONCLUSIONS

From the economic point of view, Romania is way behind the developed countries from the European Union. In order to catch up, the convergence process implies a economic and social framework that predisposes to a more dynamic evolution in terms of economic growth. In this context, supporting R&D activities is a must for Romania. As the new economy emerges – the knowledge-based economy – the sources and resources for future developments will fundamentally rely on the capacity of organizations, and the society as a whole, to generate knowledge with economic value.

Our results emphasize that the economic development and wealth creation are positively correlated with the amount of gross R&D expenses, also underlining that in order to stimulate the overall R&D activities, the prior actions must address the private sector. The analysis points out that, the more intense the experimental development and applied research are, the more developed an economy is. So, as there is clear evidence that R&D expenses that must be stimulated are the ones from the private sector, a more detailed approach conducts us to the conclusion that in order to stimulate the R&D activities, the governmental incentives in Romania should target the needs and characteristics of SMEs.

Our recommendations regarding the ways Romania could adjust its engines of economic development, and direct them in to the right direction, are the following:

1. *Creating and developing Tax Incentive Schemes for R&D activities.* It is very important to shape up the perception over the fiscal effectiveness performing R&D activities by private enterprises. Also, the psychological effect induced by the fact that R&D is a priority for the government builds confidence and raises optimism about future of the Romania's economy.

2. *Making the experimental development and the applied research a priority for the public owned research organizations, targeting an equilibrium in terms of funds allocated between these three types research.* It is vital that the public owned research institutes link more tightly their research to the current and future needs of the national and global economy, becoming more market oriented. In order to accomplish this, it is a must to involve at a larger scale the employer's organizations in designing the national strategy for R&D and the specific governmental programs.

3. *Creating and developing governmental programs that address the financing needs for R&D of the SMEs sector.* As the economic paradigm shifts to the knowledge-based one, the SMEs sector is becoming a priority. In order to make SMEs more competitive in the global arena, there is a stringent need to foster R&D activities. Also, by facilitating cooperation and collaboration for SMEs, the new forms of organizations are more likely to develop (networks, clusters etc.).

4. *Acceleration and facilitation of international know-how transfer, both technological and organizational.* Living in a globalised world, it is important to stimulate cooperation between national and external organizations, creating synergies and streamlining the R&D processes.

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