ANALYSIS OF THE INTELECTUAL DEVELOPMENT AND EVOLUTION OF RESEARCH SYSTEMS IN EUROPEAN RESEARCH AREA IN THE LAST DECADE

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Abstract: *In the present paper will be presented an analysis of the open, excellent and attractive research systems based on the economic indicators taken from IUS2010, IUS2011 that uses the latest statistics from Eurostat and other internationally recognized sources as available at the time of analysis. The datas are taken from the Proinno Europe site: http://www.proinno-europe.eu/inno-metrics/page/innovation-union-scoreboard-2011, the last document introduced by European Commision for research developpent and innovation. International scientific publications per 1 million inhabitants (IUS 2010,IUS 2011) and 10% most cited scientific publications with values taken from IUS 2010 and IUS 2011 is analyzed too. By studying IUS 2011 and IUS 2010 we be made a conclution for the period 2000 to 2010. In respect of the 10% most cited scientific publications, these values are analyzed in the period between 2000 and 2007. These datas are taken at European Union level only for the period 2004-2009. The evolution of doctoral graduates from non-EU countries which are represented as a percentage (%) of the total number of students, according to IUS 2011 is done too. A conclusion concerning the trend for the period 2005 to 2009 is made here too. Analysis of graduates of doctoral internships which belongs to ISCED 6 per 1000 inhabitants aged 25-34 years, based on data taken from the database IUS 2010 and IUS 2011 may represent the evolution of EU doctoral internship graduates during 2000-2010. Were reported in the EU only data from 2002 to 2009. It is done the analyse of the trend from 2002 to 2008. Intellectual development respectivelly publications made in public-private partnership to 1 million inhabitants which are assigned to countries where are research in companies and other private sector organization is done too. But we have here an analysis done only to European area. The analyse of scientific publications made in public-private partnership to 1 million in the period from 2003 to 2008 is done too. The present study is part of Doctoral Grant "Implications for innovation, research and development role in the development of Romania's economic competitiveness", having Director: Prof. Dr. Alina Badulescu in Oradea University, Faculty of Economic Sciences.*

Keywords: Higher Education and Research Institutions, Economic Growth of Open Economies, Economic Development, Analysis of Education, Human Capital; Skills; Occupational Choice.

JEL classification: I25 ,I23, F43, F63, I21, J21, J22, J23, J24.

1. Introduction

A knowledge-based economy is a basic factor to strengthen the competitiveness of that economy. Economic growth is the increase of activities and their results in the national economy that are closely related with factors contributing to this increase. Growth is interpreted as a positive, upward macroeconomic outcomes expressed by the dynamics of macroeconomic activity results in real terms. Economic growth is measured by the growth rate of gross domestic product, the gross national product or national income per total and per capita. Economic growth is seen as a long-term process. It is the increase in potential output and potential output. Growth is a conditional existing potential resources and how they are made (Dachin&Popescu, 2009).

A key aspect of economic growth based on innovation in the firm has to do with specific industry environment. Competitive advantages of a company come and experience management team.

A greater technological capacity and reduced unit costs raises the demand curve of the firm. There is a tendency formation and spread of scientific and professional communities. When analyzing the evolution RDI sector is considered and historical changes in industrial leadership models across countries. The role of education in economic specific types of skills helps in removing discrepancies and innovative potential in the industry. It is interesting to study university-industry relationship, namely science-technology in as many countries (Mowery & Sampat, 2006).

In the present paper after a short presentation on the literature review concerning the the origin of relationship between economic growth – research development and innovation (RDI) and competitiveness, it will be presented an analysis of the the Open, excellent and attractive research systems based on the economic indicators taken from IUS2010, IUS2011. This analysis will be done on the international scientific publications per 1 million inhabitants and 10% most cited scientific publications based on datas from IUS 2010 and 2011.

The present paper will analysis graduates of doctoral internships which represent ISCED 6, per 1000 inhabitants aged 25-34 years based on datas from IUS 2010 and 2011. It will be analysed too Intellectual development especially publications made in public-private partnership to 1 million inhabitants based on datas from IUS 2010 and 2011 too.

2. Literature review

The origins of economic growth theory, studied from one country to another, appearing in works of Abrambwitz from 1956, Solow from 1957, Denison from 1967 respectively. Technological improvements and increased productivity generated changes in accounting means substantial residual economic growth. These have the effect of increasing input factors. Thus the accumulation of capital to expand the scale of the activities undertaken relative unit labor costs are based on "price competitiveness", while the contribution of corporate research and the ability to "catching up" through imitation of a leader achievements are "non-price" technological competitiveness. technological competitiveness is considered to be more important than relative unit costs of labor. Fagerberg model introduced in 1988 is based on estimating the empirical model of international competitiveness. This was decomposed model of world trade for each country. Decomposition predicted growth rates for national market and is based on an empirical model. This model was

estimated by analyzing competitiveness from one country to another to increase technological capabilities, increasing unit labor costs relative to initial capacity, the share of investment in GDP and rising global demand. Increasing total market share was predicted by the model (Cantwell, 2006).

Competitiveness is studied to understand whether there is capacity to sustainable economic growth in a competitive environment achieved internationally. Competitiveness is studying environment there are other countries, groups or individual companies. It is studyed differentiated set of capabilities appropriate for each economy separately. (Cantwell, 2006).

More important is the increased role of innovation in modern knowledge-based economy. Even countries that start from an unfavorable position wish to catch necessary to implement innovation in their economies. Competitiveness must be designed so that they assume a relative comparison of growth rates or performance benchmarking of each participant made to build capacity for innovation and economic growth (Fagerberg&Godinho, 2006).

At the national level, competitiveness reflects how international trade evolves over time, so that it reflected the competitive advantage. Technological gap approach is closely related to model production cycle. When the model appeared in the 1970 production cycle due to the recurrence of multiple centers where to study the process of innovation in a number of international industries, modified versions of the model is based on the strategy of oligopoly rather than on theory revision based innovation and competitiveness (Cantwell, 2006).

Each national RDI efforts are necessary to promote competitive businesses and are complementary to those at the local level. Scientific and engineering community are becoming international. Border flows of knowledge are becoming increasingly common. Competition between companies stimulates RDI. The innovation reduces costs and improves product quality in the industry, and therefore increases the demand of the industry. All benefits companies successfully contribute to the process of innovation combined and interactive (Narula&Zanfei, 2006).

Long-term technological competitiveness is the relationship between RDI and competitiveness. Appropriate price competitiveness term competitiveness. Faster growth in productivity and trade, a trend appears to increase the value of the national currency, reflect competitiveness. Competitiveness is defined as a relatively rapid increase productivity and export value (Cantwell, 2006).

Concerning the technological gap between countries international competitiveness, Fagerberg formulated in his works of 1987 and 1988 increasing impact on national rates of innovation and technological leadership distance are treated primarily as additive elements that will be added to the traditional determinants of economic growth in the form of capital accumulation (investment share in national output) and relative labor costs and unit.

Innovation is seen as a source of economic growth. Technological competitiveness is a function that depends on the cost. Relationships between technological innovation capability development in firms and institutions are responsible for the company's competitiveness varies from country to country. They tend to be different in countries belonging to the group of industrialized countries who are leaders and those who are trying to catch up (Fagerberg&Godinho, 2006). There have been many cases where governments economies from "catching-up" internal protection measures have contributed actively to the promotion of local industries capacity early

and domestic companies. This was done in Germany, and Great Britain in the nineteenth century. Germany is known for its focus on a broad and deep skills acquired by emphasizing the general and engineering. Basic education standards for the population as a whole are high. The UK tends to be elitist and focuses on developing high-tech skills for a smaller group of people. The German system has a competitive advantage in the automotive and engineering based on calificare.Sistemul UK has a competitive advantage in aerospace, software, pharmaceuticals, biotechnology, medical equipment. These companies rely on individuals involved in the RDI.
Examined patterns of technological specialization among national groups were from the largest companies in countries such as Germany, UK, France, Switzerland and Sweden. These models are based on models of corporate patenting. These profiles are made for periods of sixty years from the interwar period to the present (Cantwell, 2006).
Relationships between companies and scientific infrastructure, between producers and users of innovations in the companies favor polarization and accumulation processes (Lundvall, 2008). Economies which have the effect of attracting all types of economic activity in certain regions, which would determine if corporate integration, the location of new research units.

3. Methodology of research

Analysis of relevant indicators of european competitiveness is done based on the **I**US2010 and IUS 2011. Here they are 25 indicators that comprise the national performance of RDI. 19 indicators were carried over from previous EIS2009 and 12 indicators were not modified, two indicators were merged and 5 indicators were partially modified using broader or narrower definitions or different names. Taking into account the fusion of two indicators 18, indicators are equivalent to those of IUS2010 EIS2009 and in addition have been introduced 7 indicates. IUS2011 uses the latest statistics from Eurostat and other internationally recognized sources as available at the time of analysis. IUS2011 distinguish between three main types of innovation indicators on eight dimensions, for a total of about 25 different indicators. The main input factors in the analysis of external innovation performance of companies covers three dimensions of innovation. These are: human resources, research systems open, excellent and attractive, and finance and support. Business activities relate to the company's innovation efforts, grouped into three dimensions of innovation as follows: investment firms and spirit connections antreprenorialşi intellectual assets. Output factors relate to effects on innovation activities of firms in innovation: innovators and economic effects. The 25 performance indicators show the RDI status. Some indicators of innovation at EU level such as public spending on RDI may be more easily influenced by policy interventions than others, such as private SMEs with innovation.

Determinants of competitiveness indicators at European level will be grouped as follows:

- *Influencing Factors* which are dealing with: Human Resources (New graduate doctoral Population that has attained tertiary education Youth with

upper secondary education); Open systems, excellent and attractive research (collaborative international scientific publications, top 10% most cited scientific publications, doctoral students from non-EU countries); Financing and support (Public expenditure on RDI, Venture Capital)

- *Business companies* which are dealing with: Investments in the companies (companies with RDI expenditure, non RDI expenditure of Companies); Links and entrepreneurship (internal innovations SMEs Innovative SMEs collaborating with others, public-private partnership represented in the co-publications); Intellectual Evolution (PCT patent applications, PCT patent applications in societal challenges, Community Trademarks, Community Models)
- *Results* which are dealing with: Innovative enterprises (SMEs introducing product or process innovations, SMEs introducing organizational innovations on the market);Economic effects (Employment in knowledge-based activities, exports of medium and high-tech, export of knowledge-intensive services, sales of new market innovations and new companies, revenue derived from licenses and patents obtained from abroad).

The datas were taken from the Proinno Europe site:http://www.proinno-europe.eu/inno-metrics/page/innovation-union-scoreboard-2011, respectivelly from Innovation Union Scoreboard 2011(IUS 2010 and IUS2011), the last document introduced by European Commision for research develompent and innovation.

4. Results

Open, excellent and attractive research systems

It will be presented indicators from IUS2010 and IUS2011 to analyse Open, excellent and attractive research systems

International scientific publications per 1 million inhabitants (IUS 2010,2011) and 10% most cited scientific publications (IUS 2010,2011)

Studying IUS2011and IUS2010 we can conclude that collaborative international scientific publications represented 1 million inhabitants are increasing from 132 to 1 million inhabitants in 2000 to 301 în 2010. In respect of the 10% most cited scientific publications, these values are increasing from 981 in 2000-1073 to 2007.

Although these datas from IUS2010 and IUS2011 are for 2000-2010 for this indicator. These datas are taken at EU level only for the period 2004-2009. Figure 2 presents the evolution of doctoral graduates from non-EU countries. They are represented as a percentage (%) of the total number of students, conformcu IUS2011 and can see an increasing trend from 17.1% in 2005 to 19.2% in 2009.

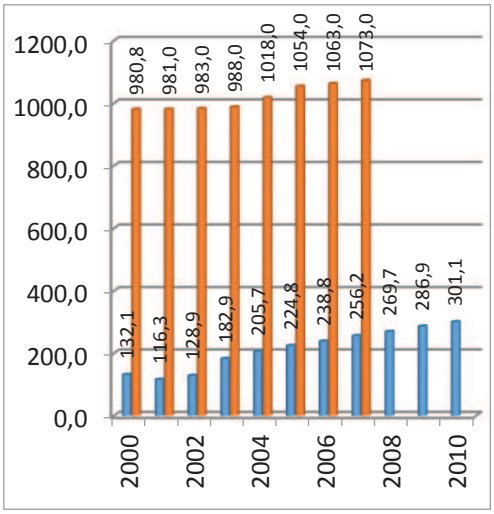

Figure 1: International collaborative scientific publications on 1 million inhabitants (IUS2010, IUS2011)is presented in blue. 10% of the most cited scientific publications (IUS 2010,2011) are presented in red.

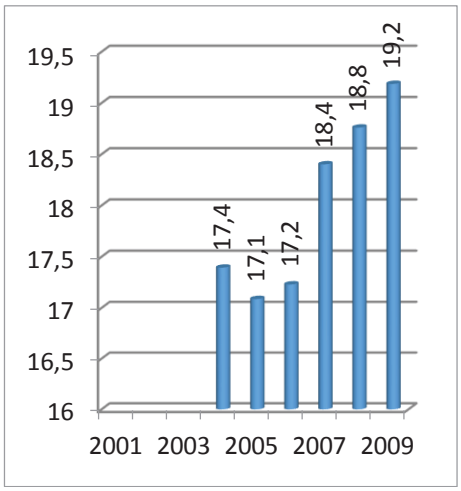

Figure 2: Doctoral graduates from non-EU countries (% of total number of students) evolution in the period 2000-2010 (Source: IUS2011 and Author's calculations)

Graduates of doctoral internships (ISCED 6) per 1000 inhabitants aged 25-34 years. Based on data taken from the database IUS 2010 and IUS 2011 may represent the evolution of EU doctoral internship graduates during 2000-2010. Were reported in the EU only data from 2002 to 2009. We can see that in 2002 there were values of 1.1 ‰ and in 2008 there were 1.5 ‰.

Intellectual development respectivelly Publications made in public-private partnership to 1 million inhabitants (Source: IUS2010, IUS 2011). The definition of "private sector" excludes private health sector and health. Publications are assigned to countries where there are research in companies and other private sector organizations. Scientific publications made in public-private partnership to 1 million increased from 31.7% in 2003 to 36.3% in 2007 and then decline again in 2008 to 36.2%.

Was done an analysis of evolution of human resource in the period 1990-2010. We It is done an analysis for doctoral internship graduates aged 25-34 and science and engineering graduates aged 20-29 based on the next official documents EIS2004,EIS2005,IUS2010, IUS2011.

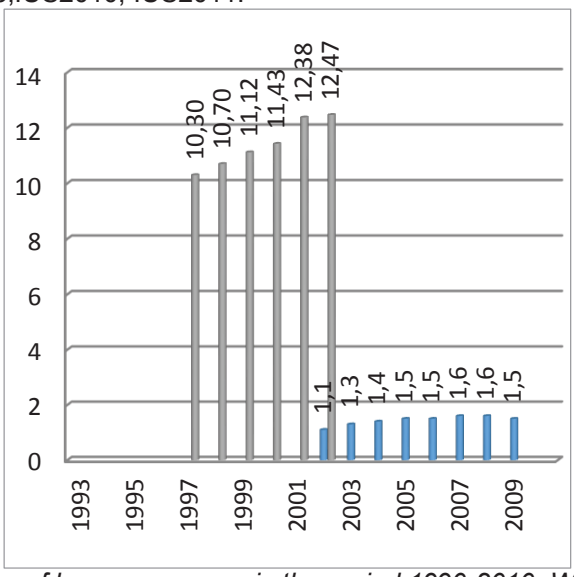

Figure 3: Evolution of human resource in the period 1990-2010. We used as follows dark blue for doctoral internship graduates aged 25-34, green for science and engineering graduates aged 20-29. (Source: EIS2004,EIS2005,IUS2010, IUS2011 and author's calculations).

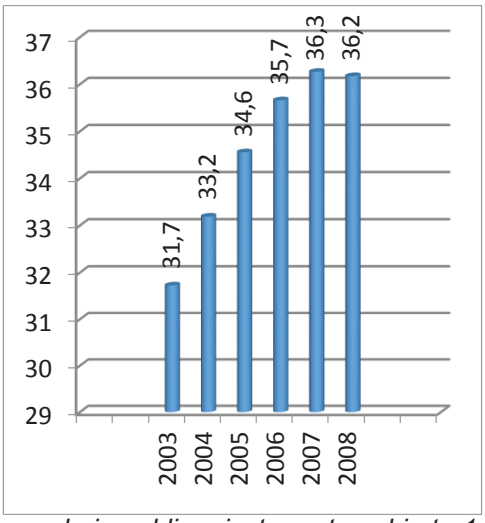

Figure 4: publications made in public-private partnership to 1 million developments between 2000-2010 (source ius2010, ius 2011 and author's calculus).

5. CONCLUSIONS

The main factors of competitiveness analysis of the relationship between Research Development and Innovation and competitiveness covers 3 dimensions of innovation which are: human resources, open, excellent and attractive research systems and finance and support, respectively. Entities that carry out activities RDI refers to efforts made innovation at the firm level, but also at public. they are grouped into three dimensions of innovation: investment firms, linkages&entrepreneurship and intellectual assets. The results of such analysis concerns the effects on innovation activities, being on two dimensions: innovators and economic effects.

All innovation leaders should have high values for RDI expenditure in business, innovation and human resources, finance and support, and investment firm. All leaders must have elevated innovation for publications made in public-private partnerships, publications made at 1 million, suggesting good links between fundamental science and business. all top european innovators must excel in marketing technological knowledge, Which is seen in their performance on foreign income from licenses and patents. overall good performance of the innovation leaders should reflect a balance national research and innovation. Effects of innovations are improving the innovative work of government. They improved working conditions or employee satisfaction. Human resources led to support innovation. More than half of employees with higher education innovation services performed but not all innovations introduced them as innovation. Future trends are increasing the number of public sector organizations in the EU who introduce innovations.

Large companies invest in RDI. Prevail throughout the EU innovation-related products and services related to actions that are reported as improved or newly introduced in the past two years. The conclusion is that innovative companies are successful.

Analysis of relevant indicators for european competitiveness is done in the present paper. The present analysis is based on the IUS2010 and IUS 2011.

IUS2011 uses the latest statistics from Eurostat and other internationally recognized sources as available at the time of analysis.
In the present paper are analyzed only Open, excellent and attractive research systems, which are indicators from IUS2010 and IUS2011.The datas were taken from the Proinno Europe site: http://www.proinno-europe.eu/inno-metrics/page/innovation-union-scoreboard-2011, respectivelly from IUS2010 and IUS2011, the last document introduced by European Commision for research develompent and innovation analysis.

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6. References

Asheim B, Gertler M, (2006), *The Geography of Innovation: Regional Innovation System,* pp. 291-617, in *The Oxford Handbook of Innovation* edited by Jan Fagerberg, D.Mowery, Richard Nelson, Oxford University Press,New York.
Bruinsma F, Nijkamp P, Vreeker R, (2000), Spatial planning of industrial sites in Europe:A benchmark approach to competitiveness analysis, Research Memorandum 2000-7. Vrije Universiteit A*msterdam,* http://econpapers.repec.Org/RePEc:dgr:vuarem:2000-7.
Cantwell J, Innovation and Competitiveness, (2006), pag. 543-567, in The Oxford Handbook of Innovation edited by Jan Fagerberg, D.Mowery, Richard Nelson, Oxford Univ. Press,New York.
Dachin A, Popescu C, (2009*), Crestere economică şi dezvoltare durabilă*, în Economie, ed.a 8-a, Editura Economică,Bucureşti,
Fagerberg J, (1996), *Competitiveness, Scale and R&D,* No 1996545, Working Papers Archives from Centre for Technology, Innovation and Culture, University of Oslo, http://EconPapers.repec.org/RePEc:tik:wparch:1996545,

Fagerberg J, Godinho M, (2006), Innovation and Catching –up, pag.514-542, in The Oxford Handbook of Innovation edited by Jan Fagerberg, D.Mowery, Richard Nelson, Oxford University Press,New York.
Fagerberg J, Srholec M, (2008),National Innovation Systems, Capabilities And Economic Development, *Research Policy* vol 37 ,pp. 1417–1435.
Fagerberg J, Srholec M, Knell M,(2007), The Competitiveness of Nations: Why Some Countries Prosper while Others Fall Behind, *World Development* Vol. 35, No.10, pp.1595–1620,
Fagerberg, J. (1987), A technology gap approach to why growth rates differ, *Research Policy,* vol. 16, no. 2-4, pp. 87-99
Howells J.,(2005),Innovation and regional economic development: A matter of perspective?, Research Policy vol.34,p.1220–1234.
Innovation Union Scoreboard 2010,*The Innovation Union's Performance Scoreboard For Research And Innovation,* http://www.Proinno-europe.eu/metrics,
Innovation Union Scoreboard 2011,*The Innovation Union's Performance Scoreboard for Research and Innovation*, http://www.proinno-europe.eu/inno-metrics/page/innovation-union-scoreboard-2011.
Mowery D, Sampat B, (2006), *Universities in National Innovation System*, pp.209-239, in The Oxford Handbook of Innovation edited by Jan Fagerberg, D.Mowery, Richard Nelson, Oxford University Press, New York.
Narula R, Zanfei A., (2006), *Globalization of Innovation: The Role of Multinational Enterprises*, pp.318-347, in The Oxford Handbook of Innovation edited by Jan Fagerberg, D.Mowery, Richard Nelson, Oxford University Press,N Y.
Nill J, Kemp R., (2009), Evolutionary approaches for sustainable innovation policies: From niche to paradigm?, *Research Policy,* vol.38,pp. 668–680.