APPROACH OF RDI SYSTEM IN EUROPEAN UNION IN THE LAST DECADE

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Abstract: *Present paper present an approach of the Research-Development and Innovation System (RDI) in Europe during the last decade. After a short introduction is presented the European Union formation. Research, development and innovation (RDI) has been studied and analyzed since 2001 by the European Innovation Scoreboard (EIS). Will be presented in the present paper a summary of all the materials from EIS 2001 till IUS 2011. Study concerning RDI system in Europe was done from innobarometers from 2001 till 2010. EIS2007 presents for the first time the European innovation leaders. EIS presents innovative performance of Member States based on annual statistical data collected from national statistical sources of each member country of the European Union through the Community Innovation Survey by using Document Analysis on Innovation Community. Were taken into account, after this short presentation, the relevant composite indicators for European Union for the last decade to analyze the Research-Development and Innovation System in Europe. IUS2011 distinguish between three main types of innovation indicators. The main input factors in the analysis of external innovation performance of firms covers 3 dimensions of innovation. These indicators, based on the IUS2011, contain as follows: Human Resources with the evolution of new doctorate graduates, population completed tertiary education, youth with upper secondary level education, Research Systems, Finance and Support. All of these indicators belongs to the category of Enablers. Another indicators studied in the present paper are Firm activities, Linkages & entrepreneurship Intellectual Assets. From the category of Outputs there are Innovators and Economic effects. The composite indicators for EU Research Development and Innovation System were study for the period 2006-2011. Samples data were took from Pro Inno Europe database for simulations in August 2012.*
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1.Introduction

Present paper will make an analysis of the research development and innovation activities in European Union in the last decade.

Lisbon strategy introduced in 2000 was meant to transform by 2010 the European Union into "the most dynamic and competitive–based economy in the world" (Lisbon Strategy, 2000). 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 are closely linked to factors contributing to this

increase. Economic growth is interpreted as a positive development trend of macroeconomic outcomes expressed by the dynamics of macroeconomic activity results in real terms. Macroeconomic dynamics is correlated with demographic dynamics. Macroeconomic indicators are related to the total population. Economic growth is measured by the growth rate of GDP, the gross national product or national income per total and per capita. Economic growth is seen as a long-term process. It is the growth of potential output and potential output. Growth potential depends on existing resources and how they are made (Dachin&Popescu, 2009).

Economists and economic historians from Adam Smith raised the question of national economic growth. They wondered why some countries grow more rapidly? If these countries have the necessary capabilities for sustainable growth? Makes them more competitive in some countries than others and why some become richer than others? Attention has shifted from growth problems in the allocation of resources. The theory of firms comparative growth was first introduced in the works of Downk in 1958, Penrose in 1959 and Marris 1964. This was treated as a sub-branch of the industrial economy, which was a theoretical relationship between the firm and markets. Competitiveness is studied to understand whether the necessary capacity for sustainable growth in a competitive environment made internationally. Competitiveness is studying environment there are other countries, groups or individual companies. It is studied differentiated set of capabilities appropriate for each savings share. (Cantwell, 2006).

Present paper present an approach of the Research-Development and Innovation System (RDI) in Europe during the last decade. After a short introduction is presented the European Union formation. RDI has been studied and analyzed since 2001 by the European Innovation Scoreboard (EIS). Was presented in the present paper a summary of all the documents from EIS2001 till IUS2011. Study concerning RDI system in Europe was done from Innobarometers from 2001 till 2010. Were taken into account, after this short presentation, the relevant composite indicators for European Union for the last decade to analyze the Research-Development and Innovation System in Europe. IUS2011 distinguish between three main types of innovation indicators. The main input factors in the analysis of external innovation performance of firms covers 3 dimensions of innovation. These indicators, based on the IUS2011, contain as follows: Summary Innovation Index, Human Resources, Research Systems, Finance and Support, Firms investments, Linkages&entrepreneurship, Intellectual Assets, Innovators, Innovators, Economic effects for European Union (Source: http://www.proinno-europe.eu/metrics).The composite indicators for EU Research Development and Innovation System were study for the period 2006-2011.

2.A short aproach of RDI system in EU during EU formation

European Union (EU) is an economic and political union consisting of 27 member states which are located primarily in Europe. In 1951 was founded the European Coal and Steel Community (ECSC). In 1958 was established the European Economic Community (EEC). In 1957 EU6 is formed, the first form of existence of the EU.

EU6 was formed in 1957 from the following countries: Belgium, France, West Germany, Italy, Luxembourg, Netherlands. When EU6 was created in 1957, had a total population of 169,106,736 inhabitants, comprised an area of 1,299,536 km2.UE6 have a GDP of $ 1.123317 trillion and a GDP/capita of $ 6,643.   In

1973 EU9 was formed with Denmark, Ireland, UK in adition to EU6. EU9 thus formed, which has a population of 256,762,106 inhabitants, an area of 1,657,723 km2, a GDP of U.S. $ 3.148472 trillion, or a GDP / capita of $ 12,262. In 1981 Greece joins the EU, thus forming the EU10. Population grew by 3.72% and reached 271,472,541 people. Area increased by 7.96% from 1973, to EU9. Even if the total GDP of the newly formed EU10, increased by 2.34% to 3.781111 trillion $ GDP/capita fell by 1.33%. In 1986 Portugal and Spain joined the EU and they make the EU12. The two countries have led to an increase in GDP of the EU to 11.29%. GDP/capita decreases by 5.51% to the value of $ 14,468 / capita. Population grew by 17.53% and EU12 area increased by 33.37% to 2,386,841 km2. In 1995 to the EU12 joins Austria, Finland and Sweden, forming EU15. GDP per capita increased by 0.2%. EU15 population increases by 6.28%, the area increases by 34.95% and EU15 GDP increased by 6.5%. In 2004 another 10 countries join the EU15 and formed EU25. These are: Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, and Slovenia. These 10 countries contribute to population growth by 19.5%, thus EU25 population reached 456,504,305 inhabitants. Surface increases by 17.97% and becomes 4,104,844 km2. EU GDP increases only 8.88% and reached $ 8,396,994,000,000 of, but GDP per capita decreases by 8.94%, making him $ 18,394 /capita. In 2007 Romania and Bulgaria join the EU and thus form the EU27. These two countries contribute 2.04% to EU GDP in 2007 which became worth $ 12,436.80 billion and GDP per capita decreases by 4.03% and becoming in 2007, $ 25,160.59 / capita. EU area increased by 6.48% in the two countries, reaching 494,296,878 inhabitants and the area is 4,454,237 km2 and in EU27 is increasing to 8.51%. In 2011, the EU27 has a population of 502,486,499 inhabitants and EU GDP of $ 15,788 billion and a GDP/capita of $ 31,548.
(Source: http://epp.eurostat.ec.europa.eu)
Research, development and innovation (RDI) has been studied and analyzed in the present paper since 2001 by the European Innovation Scoreboard (EIS). EIS2007 presents for the first time that EU innovation leaders. EIS presents innovative performance of Member States based on annual statistical data collected from national statistical sources of each member country of the European Union through the Community Innovation Survey (Document Analysis on Innovation Community).
European Innovation Scoreboard (EIS) is a document that contains information about: performance of Research Development and Innovation (RDI) in Europe. I took and studied every document since EIS2001 to IUS2011 respectively Inobarometers from 2000 to 2010. Next I will present a brief summary of the 22 official documents downloaded from the official website of the EU: http://www.proinno-europe.eu/metrics.
EIS2001 is the explicit answer of European Council meeting in Lisbon, establishing that the European economy have to be a dynamic, knowledge-based, social cohesion respectively. It was established that the RDI European area naem to be ERA (European Research Area). Statistical analyzes are made here for 17 indicators in 4 areas, such as human resources, knowledge creation, transmission and application of new knowledge, financial innovations and marketing results. Analyses are performed for 1999 and 2000. In the 2001 report states that leaders of innovation in Europe are Finland, Sweden, Denmark. These countries have enormous potential for RDI. All member countries improve their innovation performance. UK achieved the fastest way. Just manages of Denmark, Finland, Greece, Luxembourg and Spain, which are now entering countries in the catching-

up category. Many indicators regarding RDI in Europe are heavily influenced by public policies and strong investment in RDI or in achieving tertiary education especially after 1996.

Innobarometer 2001 examines the experiences and priorities of European managers on innovation activity. According to European managers, innovation is widespread, but it is a slow development. It appreciates the importance of innovation in most businesses. Adequate human resources, active contacts with customers and suppliers, and sharing knowledge with other innovative companies are considered important elements of innovation. However, tax incentives for innovation are considered insufficient in most EU countries. On the other hand, most of the directors claim that customers have a favorable attitude towards innovation. German customers are regarded as being particularly exposed to innovative products.

EIS2002 complete a survey of a new field of innovation, biotechnology and introduce the methodology for reporting the status of innovation in Europe in 2002.

Innobarometer 2002 examines european companies, which slowly but continuously strengthens their innovative activities between 2001 and 2002. Skilled workforce with the knowledge and skills necessary for a strong performance in innovation is regarded as essential in this context. Innovative market access are considered too. Another trend is observed in the period under investigation is that more and more companies took part in the increasingly public debate on innovation. Is highlighted the importance of cooperation between enterprises.

EIS2003 analyzes RDI achieved in the EU in 2003. Technical data indicate important economic issues such as: definitions of economic indicators that characterize the European Innovation at a time, analyze the performances. The results presented in the EIS documents include current data and trends, determining what innovation leaders, weaknesses and strengths of each country component of the EU. Analyses were performed for regional development, respectivelly for 173 regions from 13 Member States in 2003. Were studied on this occasion 9 structural indicators and 14 indicators of socio-cultural and institutional background specifying the conditions for innovation activities in each EU Member State. Was done on this occasion description of the methodology for calculating the summary innovation index SII (Summary Innovation Index) for each country.

Innobarometer 2003 reveal that the number of EU companies that have engaged in innovative activities increased from 2002 to 2003. An important factor is the consumers that encourages companies to innovate. Generators of research and development are the engines of innovation. Managers see globalization as an opportunity to innovate and are optimistic about the benefits of innovative efforts. At the same time is seen favorably European dimension of innovation issues such as the community patents.

EIS 2004 contains information about the candidate and who tend to join the EU, their Performance for RDI -business activities. EIS2004 includes a database with information on each economic indicator which characterizes RDI. This information is presented for each country component of the EU. This information presents the ways of achieving RDI, diversity, innovation feature of market knowledge flow, investments in RDI, innovation in governance respectively. Indicators study covers the period 1993-2004. Countries for which was made the analysis are: Austria, Belgium, Germany, Denmark, Greece, Spain, Finland, France, Ireland, Italy, Luxembourg, Netherlands, Portugal, Sweden, UK, EU15, Cyprus, Czech Republic, Estonia,

Hungary, Lithuania, Latvia, Malta, Poland, Slovenia, Slovakia, EU25, Bulgaria, Romania, Turkey, Iceland, Norway, USA and Japan.

Innobarometer 2004 seeks public support measures for innovation programs from a business perspective. This analysis includes 25 Member States. Analysis is performed for 4,500 innovative companies with a number between 20 and 500 employees. Through Innobarometer 2004 is the innovation performance of Member States and associated countries. One third of EU's innovative companies use at least one form of public support for their innovation activities. However, few companies use public support for innovation, for which they are eligible, which shows that further improvement can be achieved in terms of coverage of public initiatives. It was found that the Cypriot and Austrian firms are most active. Companies from new member states use less public support for innovation.

2005 EIS presents results of RDI activities and reporting methodology used in this year. This is how to assess and compare the innovation performance of EU countries and USA. There are also studies of the weaknesses and strengths of innovation results and economic performance of the EU Member components.

Innobarometer 2005 analyzes how people are ready for innovation in 2005. It is analyzed here how europeans define innovative products and services and the extent to which people are drawn these. This information was used to evaluate the overall innovation. It appears that Malta and Slovakia are Member States with the highest proportion of citizens pro-innovation. Many other countries are in the same situation. Citizens of Poland and Latvia are not prepared to accept the innovations. A study was conducted where three from five citizens of these countries are classified as "anti-innovation" or "reluctant". Peoples "anti-innovation" are in Greece, Cyprus, Portugal, Bulgaria. Most EU citizens more innovation associated with creating new products or services, improve existing ones. The vast majority of European citizens said that they feel attracted to innovative products or services.

EIS 2006 includes innovation indicators. Trends analysis is performed here for innovation in EU25 Member States plus the two new Member States: Bulgaria and Romania, and Croatia, Turkey, Iceland, Norway, Switzerland, USA and Japan. Corresponding Annex of EIS2006 contains tables with definitions and datas for each country. EIS2006 report and its annexes are accompanied by thematic papers and corresponding indicators database. In EIS2006 there is a comparative study between EU, USA and Japan, countries where RDI has important results.

Innobarometer 2006 presents descriptive information on the concepts of membership in a particular cluster and cluster impact on the economic competitiveness of Europe. Study finds that corporate managers are generally aware of the relatively new concept of clusters of companies, especially in the old Member States. It was found that EU action is placed in a cluster consisting of at least 4 companies with at least 20 employees. They are characterized by close cooperation with other local businesses and close links with local business infrastructure. The highest density of clusters is in UK, Ireland and Latvia. The benefits of belonging to a cluster are in the category of human resources, entrepreneurship and partnership development. Three quarters of business leaders strategic component clusters in the EU considers strong competition and competitiveness generator, which ensures the success of clusters. Companies operating in the cluster are more innovative. Public authorities has an important role in supporting clusters (Source: http://www.proinno-europe.eu/metrics)

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EIS 2007 include RDI indicators and trend analysis of the EU27 Member States. Data presented here are for EU27, Croatia, Turkey, Iceland, Norway, Switzerland, Japan, USA, Australia, Canada and Israel. For the first time were included in these types of analyzes Australia, Canada and Israel. Is made here a comparison between EU member states of these countries. This year EIS analyzes the RDI services, factors influencing innovation performance and efficiency. EIS2007 reflect analyzes of seven years of experience in benchmarking countries of RDI.

Innobarometer 2007 refer to the transfer of innovation. Here is how companies innovate, role-based innovations RDI innovations made without research and development process. Innovation can be outsourced or transferred to other companies or organizations. In a number of Member States of the EU and Norway and Switzerland intensive industries are selected to be involved in innovation. It requires that innovation process is involved in about nine of ten companies. In Finland, Hungary or Sweden every euro is spent on RDI. Innovation leads to increased turnover. Innovative companies are successful. The figures do not indicate that innovative companies that have a turnover which has been growing in recent years. Innovation is more characteristic for larger firms.

EIS 2008 provides a comparative assessment of the innovation performance of EU Member States, in accordance with the Lisbon Strategy. Revised methodology for EIS2008 is compared to 2007. The focus is increasingly on services, the non-technological innovation outcomes. Analyze temporal trends based on changes in the absolute values of the indicators for five years. Previous approach to innovation trends were performed by measurements made in relation to the EU average.

In 2008 it was realized no innobarometer.

EIS 2009 monitor the implementation of the "Europe 2020" strategy. The EU is seen as an Innovation Union. Provides a comparative assessment of the innovation performance of the EU27 Member States. Are presented the strengths and weaknesses in RDI systems. Studying innovation in the European Union can be seen next event at European level thus created groups of countries were was identified by computational methods of group clustering such as Ward method, the method connection between groups, the method links inside groups, nearest neighbor, farthest neighbor, median and central clustering methods (Source: http://www.proinno-europe.eu/metrics).

Innobarometer 2009 made a profile of innovative companies which are coming from innovative intensive sectors, with at least 20 employees, based on innovation as the primary source of income. Hungary has the most companies which have innovation. In Cyprus and Finland there are many companies that are dependent on innovation as the main source of income. Were introduced in 2006-2008, innovations for products, services, processes, marketing strategies, organizational changes. Companies from Slovenia, Finland, Switzerland and Sweden have introduced at least one type of innovation. Hungary and Bulgaria were at the lower limit on the introduction of innovations. Expenditure done for machinery, equipment or software was the most common form of innovative investments. Most companies had a stable budget for innovation or stagnation due to inflation from 2006, 2008 and 2009. Direct effects of the economic crisis in this period did not result in any changes in RDI expenditures. Production companies of high-tech increased RD expenses during the period of growth stagnation. A large number of companies at the border of UK, Spain, Poland supported innovation activities, but not France, Germany and Italy. Slovenia, Cyprus, Ireland and Luxembourg had intense international activities to support

innovation. Businesses operating across borders within the EU have supported innovation in the EU, especially in high-tech manufacturing sector, which most demanding customers. Companies in this category have received income from sales of innovative products and services. Public policies can influence innovation activities too.

IUS 2010 analyzes the innovation in EU27. The new tool is designed to help monitoring and implementing the "Europe 2020"strategy which provides innovative performance EU27 Member States and the strengths and weaknesses of RDI systems. IUS2010 conclusions on relationship between performances of RDI countries competitiveness are: 1.Innovation Leaders: Denmark, Finland, Germany, Sweden showing performance significantly above that of the EU27; 2.Innovation Followers: Austria, Belgium, Cyprus, Estonia, France, Ireland, Luxembourg, the Netherlands, Slovenia and the UK have a performance close to that of the EU27; 3.Moderate innovators are: Czech Republic, Greece, Hungary, Italy, Malta, Poland, Portugal, Slovakia and Spain is below that of the EU27; 4.Modest Innovators are: Bulgaria, Latvia, Lithuania and Romania for the innovation performance is well below that of the EU27. Bulgaria, Estonia, Malta, Romania, Portugal and Slovenia are leading growth, with an average annual growth rate of more than 5%. (Source: http://www.proinno-europe.eu/metrics)

Innobarometer 2010 found main effects of innovations in public administration. At EU level, two-thirds of public administration introduced a new or significantly improved service in the last 3 years. Innovation in services increased probability proportional to size institutions both public and private ones, which were observed in the leading innovators in public sector organizations. Process leading innovators were usually large organizations of national or central type. The most important engine for innovation in the public sector was the introduction of laws and regulations. Major sources of innovation is based on ideas from staff, management ideas, ideas from customers or users. Were introduced innovative practices from the bottom up. Was mentioned managerial support for testing ideas for the process error. (Source: http://www.proinno-europe.eu/metrics)

IUS 2011 include indicators of innovation and trend analysis for the EU27 Member States as well as Croatia, Iceland, the former Yugoslav Republic of Macedonia, Norway, Serbia, Switzerland and Turkey. This includes comparisons between EU27 and other 10 countries worldwide. The main data analysis of external innovation performance of firms covers 3 dimensions of innovation as follows: human resources, open, excellent and attractive research systems, and finance and support. Business activities refer to efforts made at the company's innovation, innovation grouped into three dimensions: investment firms, linkages and entrepreneurship and intellectual assets. The results refer to effects on innovation activities of firms in innovation, which are the two dimensions: innovators and economic effects (Source: http://www.proinno-europe.eu/metrics).

3.Analysis of relevant indicators for European RDI systems

IUS2011 distinguish between three main types of innovation indicators. The main input factors in the analysis of external innovation performance of firms covers 3 dimensions of innovation.

Figure 1 contain composite indicators for EU for the period 2006-2011. These indicators, based on the IUS2011, contain as follows: Summary Innovation Index, Human Resources, Research Systems, Finance and Support, Firms investments,

Linkages&entrepreneurship, Intellectual Assets, Innovators, Innovators, Economic effects for EU (Source: http://www.proinno-europe.eu/metrics).

Summary Innovation Index (SII) gives an overview for the moment of aggregate national innovation performance. This is an indicator which has the highest value in 2011 respectively 0.539 and the lowest value in 2006 as 0.505. The SII is calculated using the most recent statistics from EUROSTAT and other internationally recognised sources as available at the time of analysis, as in IUS2011. As a consequence the SII does not capture the most recent changes in innovation performances, or the impacts of policies introduced in recent years which may take some time to impact on innovation performance. Human Resources present the evolution of new doctorate graduates, population completed tertiary education, youth with upper secondary level education. This indicator has the highest value in 2011 respectivelly 0.563 and the lowest value is 0.496 obtained in 2006 and 2007. Research Systems present the evolution of international scientific co-publications, scientific publications among top 10% most cited, non-eu doctorate students. This indicator has the highest value in 0.530 in 2011 and the lowest 0.481 registered in 2007. Finance and Support present the evolution of public RDI expenditure and venture capital. This indicator vary between 0.617 in 2007 and 0.581 in 2009. All of these indicators belongs to the category of Enablers. To the Firm activities belongs: Firms investments with evolution of RDI Business expenditure and Non-RDI expenditures. This indicator vary between the lowest value of 0.440 registered in 2011 and 0.531 which is the highest value registered in 2006. Linkages & entrepreneurship present the evolution of SMEs innovating in-house, innovative SMEs collaborating with others, public-private co-publications. This indicator vary between 0.412 in 2006 and 0.487 in 2011. In the category of Intellectual Assets is presented the evolution of PCT patent applications, PCT patent applications in societal challenges, Community trademarks, Community designs. This indicator vary between 0.551 registered in 2011 and 0.446 in 2006. From the category of Outputs there are Innovators with evolution of SMEs introducing product or process innovations, SMEs introducing marketing/organisational innovations and Economic effects with evolution of Employment in knowledge-intensive activities, Medium and high-tech product exports, Knowledge-intensive services exports, Sales of new to market and new to firm innovations, Licence and patent revenues from abroad. Innovators is an indicator which vary between 0.597 in 2006 and 0.506 in 2011. Economic effects is an indicator which vary between 0.533 in 2006 and 0.585 in 2011.
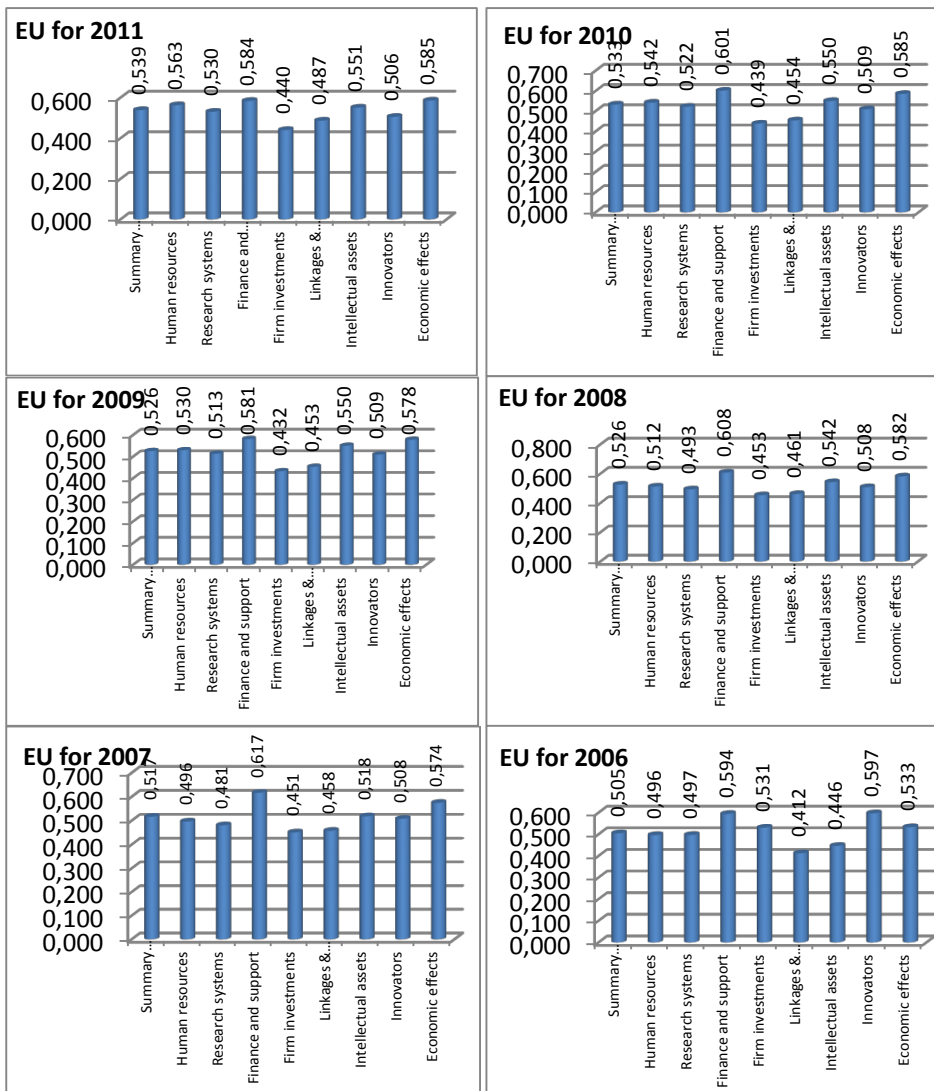
Figure 1: Composite indicators for EU during period 2006-2011. (source:http://www.proinno-europe.eu/inno-metrics/page/innovation-union-scoreboard-2011).

4.CONCLUSIONS

The relevant composite indicators analysis for the European Union RDI system covers the next dimensions of innovation as follows: human resources, open, excellent and attractive research systems, finance and support respectively. Entities that carry out RDI activities refers to efforts made for innovation at the firm level, but also at public level too. They are grouped into 3 dimensions of innovation: investment firms, linkages and entrepreneurship and intellectual assets. The results of such analysis concerns the effects on innovation activities, which are: innovators and economic effects. For this reason all innovation leaders should have high values

for RDI expenditure for the categories of business, innovation, human resources, finance and support and firm investment. All innovation leaders should have high values for publications made in public-private partnerships, publications made at 1 million peaple, suggesting good links between fundamental science and business. All top European innovators must excel in marketing technological knowledge, which can be seen from their performance on foreign income from licenses and patents. Good overall performance of innovation leaders should reflect a balanced national research and innovation. Effects are improving business innovation innovative public administrations. They improved working conditions and employee satisfaction. Human resources can support innovation. Future trends are increasing the number of public sector organizations in the EU27 introducing innovations.

This analysis is done in corelation with all the RDI documents from EIS2001 to IUS2011 and Innobarometers 2001 to 2010.

The main findings from the present study are: that Human Resources and Research Systems are increasing in the last decade. Finance and Support present the evolution of public RDI expenditure and venture capital is an indicator which has the highest values in 2007. The indicator Firm shows an increase in the last decade. Intellectual Assets which present the evolution of PCT patent applications, PCT patent applications in societal challenges, Community trademarks, Community designs is an indicator which show an decrease in the last decade. Innovators shows an decrese in the last decade and Economic effects shows an decreasing variation in the last decade.

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