THE ROLE OF INNOVATION IN COMPETITIVENESS AND CONVERGENCE PROCESS: A BENCHMARKING STUDY FOR EUROPEAN REGIONS

George M. Korres
Visiting Fellow, University of Newcastle, Centre of Urban and Regional Development Studies, CURDS, Newcastle, United Kingdom, George.Korres@ncl.ac.uk and Associate Professor at the University of Aegean, Department of Geography, Email: gkorres@hol.gr and gkorres@geo.aegean.gr
and
Aikaterini Kokkinou
Department of Economics, University of Glasgow, Adam Smith Building, G12 8RT, Glasgow, United Kingdom, E-mail: a.kokkinou.1@research.gla.ac.uk

Abstract:
Globalization and competition has shifted the comparative advantage of economies towards the factor of knowledge and innovation, where productivity based on the endogenous development capabilities plays a rather important role, as far as growth and competitiveness enhancement are concerned. In order to promote innovation activities and technological opportunities, productivity enhancement seems to have significant effects on the long run performance of the economy. Within this framework, the enhancement and convergence of growth and productivity are a major topic in the economic and social policy agenda of E.U. members, since governments seek to concentrate on problems not only related to low employment growth, high unemployment, fiscal deficits and public debt, but also to national disparities and convergence attainment. This paper aims to review the main topics related to innovation activities, as well as competitiveness and economic convergence attainment. It also attempts to analyze, using a benchmarking approach, the effects of innovation activities, in order to clarify the related implications on regional convergence process.

Key Words: Innovation, Research and Development, Regional Convergence, Regional Growth, Disparities, Development

1. Introduction

Innovation activities play an important role to productivity and competitiveness of a country. Innovation is particularly important for regional development and cohesion (Pavitt & Walker 1976). Technology policy has been heavily concerned with the external gap of the EU *vis-a-vis* Japan and USA. However, the same gap also exists among EU countries. It is true that technological competition among Japan, the USA and European Community is intense. However, Europe still needs to exploit better its scientific and technological output, notably in terms of selling high-tech goods on world markets. While its share of high-tech exports has grown slightly since the mid-2000s, in 2010, the EU still had a lower market share than the US. Over the past decade, we have seen developing Asian producers emerging as important players in high-tech market niches.

The EU must make full use of the international dimension of innovation. Two-thirds of world innovations and scientific discoveries are made outside the EU, and most expanding markets are to be found outside Europe. The main effort must nevertheless be made at a local, regional or national level. The European Union proposes to analyse in more detail those activities which, in collaboration with local governments, in order to establish a joint reference framework and help them identify priority options and opportunities for cooperation. Priorities differ among European member states according to the current situation of science, technology and innovation system in each country. Greater priority should be given at both national and European level to disseminate organisational innovations and use information and communication technologies.

This paper focuses in a benchmarking analysis for innovation activities, competitiveness and regional growth for European member states. The paper attempts to examine the implementation of European innovation policy and furthermore to analyze the effects in competitiveness and cohesion process for European member states.

2. European Innovation Policy: Lessons and Prospects

For many years, technological change has been widely considered as an *engine of growth* and an important factor in development process. Today, there is keen technological competition among EU, the USA and Japan. The aim is to reinforce technological capabilities and international competitiveness. European technology policy also aims to increase convergence among member states and to reduce disparities of the Community's less favoured regions. European technological policy is implemented through various rolling framework research programmes, which consist of various research projects and cover various sectors and scientific subjects.

Today, there is a large technological gap between advanced and less favoured regions within the EU. The countries of Europe have a long cultural and scientific tradition. Major scientific discoveries and the main developments in technology are products of European civilisation. The Treaty of Rome did not endow the Commission with explicit power to conduct research and technology policy. The Commission operated only through unanimous decisions of the Council of Ministers. In the first phase of the Community's research policy only eight articles from Euratom (1957) treaty were devoted to the promotion of research activities. The evaluation of European innovation policy can be summarised as following (Korres, 1996 & 2011):

- During the 1960s, several attempts were made to develop cross national research groupings. In 1960s, nuclear power was one of the most important areas of new technology; the Commission's power in this field derived from the Euratom treaty of 1957.
- In the early 1970s, the research that was undertaken at JRC (Joint Research Centres) focused on other fields, such as the environment, solar energy and materials. In the 1970s, the European Space Agency (ESA) was developed with participation of all Western European countries. This created a *research space community* of scientists, engineers, policy makers and industrialists. In November 1971, the COST European programme in the field of Cooperation in Scientific and Technical research was established. COST was a useful framework to prepare and carry out pan-European projects in applied scientific research.
- During 1980s there was an unsteady technological policy without any apparent results. In this period, there was a tendency to increase the allocation of funds to R&T activities. The Commission launched FAST (Forecasting and Assessment in the field of Science and Technology) experimental programme. The main objective of FAST was to define the long-term priorities and objectives of the Community's technological policy. The EUREKA project was launched in 1985 and it had already reached total committed investment by governments, companies and research institutes of more than 8 billion €, deriving from almost 500 projects.
- In the 1990s, the Single European Act (SEA) makes substantial amendments to the Treaty of Rome. The European Single Act aims to develop social and environment policies and to establish a genuine European research and technological Community. The Single European Act (SEA) explicitly legitimised the Community dimension in scientific and technical co-operation within Europe by giving the Community formal power in the fields of research and technology. Articles 130f-130g of SEA embody a research and technology policy that enjoys equal status with other Community areas, such as economic, social and competition policy. The principles introduced by the Single European Act are repeated, confirmed and extended in Maastricht. The European' action plan covers successively some aspects linked to the effectiveness of support for research and to improvement regarding the framework and the effectiveness for R&D activities and redirecting public resources towards research and innovation;
- Agenda 2000 made a major effort to simplify the Structural Funds and develop structural adjustment of lagging regions and to increase modernization through, innovation education and training systems. The European Council of Barcelona (March 2002) emphasized the importance of research and innovation by setting the goal of increasing the level of expenditure in research and development to 3% of GDP by 2010. This has been initiated through the creation of the European Research Area (ERA) and related policy actions, such as the "benchmarking of national research policies". The ERA is the broad heading for a range of linked policies attempting to ensure consistency of European research and facilitate the research policies of individual member states in order to improve the efficiency of European research potentialities. The EU is making a great effort in developing and coordinating innovation policies, adopting a joint innovation

- framework based on common legal bases (Art. 157 and 163-173 of EU Treaty), policy plans (Lisbon Strategy), programs of action (R&D Framework Programs) and networks, all conforming the European Research Area (ERA).
- "Europe Strategy 2020" is a 10-year growth strategy proposed by the European Commission in March 2010 for reviving the economy of the European Union to become a sustainable and inclusive economy. The EU identifies three key drivers for growth, to be implemented through concrete actions at EU and national levels towards sustainable and inclusive growth fostering knowledge, innovation, education and digital society, making production more resource efficient while boosting competitiveness and raising participation in the labour market, the acquisition of skills and the fight against poverty.

To sum up, we can say that there were at least three major benefits from technological collaboration within European Union:

- Cost savings for both research and production;
- Reinforced competitiveness as against USA and Japan;
- Technological convergence of European member states.

3. The Puzzle of Innovation and Regional Competitiveness: A Benchmarking Approach

Europe is, however, still under-investing in knowledge and skills. The EU is still lagging far behind the US and Japan in R&D investment and the exploitation of technological innovations; in many domains the gap is still widening.

The EU is one of the most prosperous economic areas in the world but the disparities between its member states are striking, even more so if we look at the EU's 250 regions. To assess these disparities, we must first of all measure and compare the levels of output generated by each country, as determined by their gross domestic product (GDP). For instance, in Greece, Portugal and Spain, average per capita GDP is only 80% of the EU average. Luxembourg exceeds this average by over 60 percentage points. The ten most dynamic regions in the EU have a GDP almost three times higher than the ten least developed regions. Figure (1) illustrates the innovation gaps for the period 2005-2009 for EU27 *vis-a-vis* US and also Japan, respectively. The performance for each reference year is measured using on average data with a two years lag. Figure (2) illustrates the gross domestic expenditure on R&D as a percentage of GDP for EU27 *vis-a-vis* US and Japan, respectively for the period 1997-2007. Table (1) illustrates some of the main factors explaining the American and Japanese success. Figure (3) illustrates the few regions of high technology clusters in the world. Table (2) illustrates a relative research activity index for EU for the time span 1996-2008.

Figure 1: Innovation Gaps: EU27 *via-a-vis* US and EU27 *vis-a-vis* Japan (Source: Eurostat)

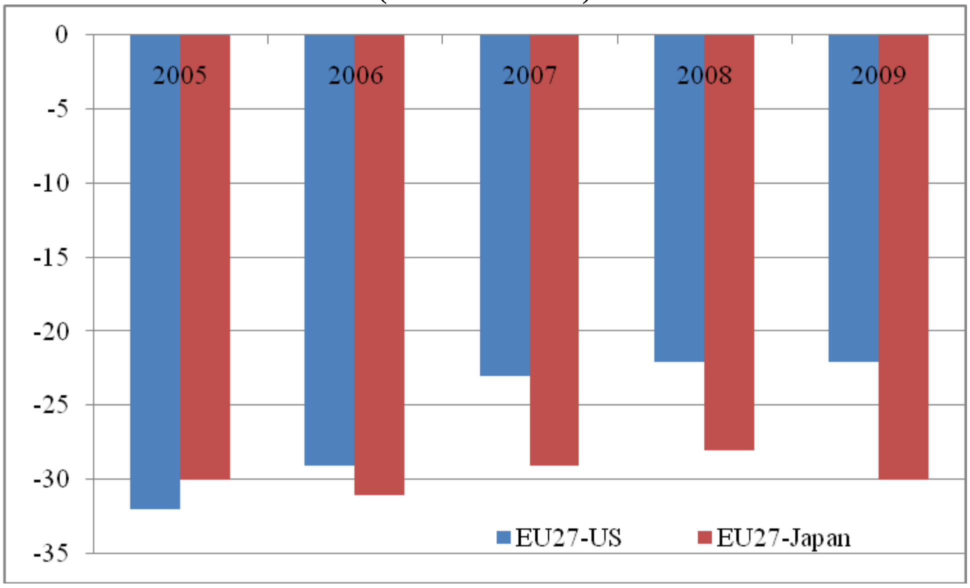


Figure 2: Gross Domestic Expenditure on R&D as a percentage of GDP (Source: Eurostat)

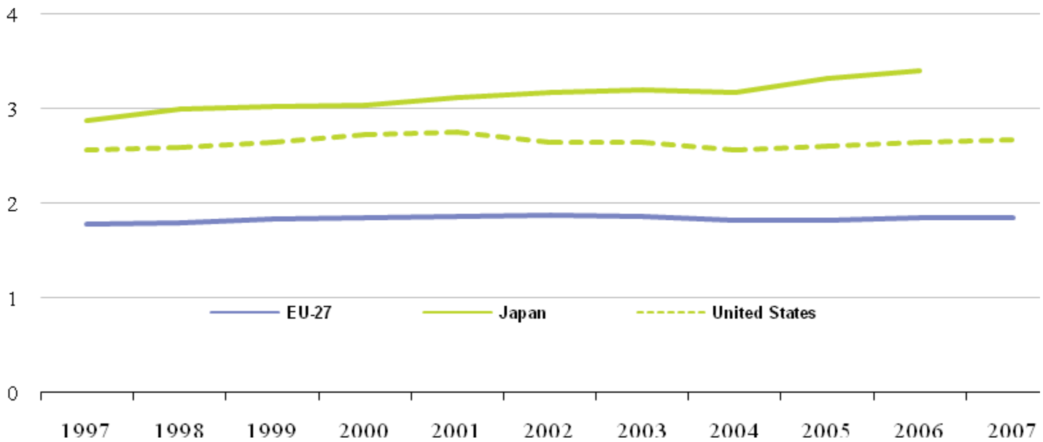


Table 1: Factors Explaining American and Japanese Success

United States	Japan
• A more intense research effort	• high level
• A larger proportion of engineers and scientists in the active population	• high level
• Research efforts better coordinated, in particular with regard to civilian and defence research (in particular in the aeronautic, electronic and space sectors).	• A strong ability to adapt terchnological information, wherever it comes from. A strong tradition of cooperation between firms in the field of R&D
• A close University - Industry relationship allowing the blossoming of high technology firms.	• An improving cooperation University / Industry, especially via the secondment of industrial researchers in Universities
• A capital risk industry better developed which invests in high technology. NASDAQ, a stock exchange for dynamic SMEs.	• Stable and strong relationships between finance and industry fostering long term benefits and strategies.
• A cultural tradition favourable to risk taking and to enterprise spirit, a strong social acceptation of innovation.	• A culture favourable to the application of techniques and on going improvement.
• A lower cost for filing licenses, a single legal protection system favourable to the commercial exploitation of innovations	• A current practice of concerted strategies between companies, Universities and public authorities
• Reduced lead time for firms creation	• A strong mobility of staff within companies.

Source: Korres (2011)

Following the results of the European Innovation Scoreboard, (2009 & 2010) for the innovation and R&T performance between Japan *vis-à-vis* EU, Japan is performing better than the EU27 in 12 indicators, only in trademarks, technology balance of payments flows, knowledge-intensive services employment and Knowledge-intensive services exports is the EU27 performing better. The Japanese innovation lead is however decreasing, as its innovation performance has grown at 1.65% while the EU27 is growing at an annual rate of 2.65%. The EU27 is closing the performance gap with Japan in S&E graduates, tertiary education, researchers, public R&D, public-private co-publications and medium-high and high-tech manufacturing exports. The EU27 is increasing its lead in trademarks, technology balance of payments flows and knowledge-intensive services employment. Japan is improving its lead in business R&D, patents, medium-high and high-tech manufacturing employment and Japan is marginally closing the gap in knowledge-intensive services exports

Figure 3: World High Technology Clusters

Source: OECD

Regarding innovation and R&T performance between USA *vis-à-vis* EU, the innovation and R&T performance the US is performing better than the EU27 in most of research and innovation indicators. Only in S&E graduates, trademarks, technology balance of payments flows and medium-high and high-tech manufacturing employment is the EU27 performing better. There is a clear performance gap in favor of the US. The US innovation lead is declining, as its innovation performance has grown at an annual rate of 0.95% while the EU27 is growing at an annual rate of 2.65%. The EU27 is closing the performance gap with the US in tertiary education, researchers, public R&D, venture capital, broadband subscribers, public-private co-publications, knowledge-intensive services employment and medium-high and high-tech manufacturing exports. The EU27 is increasing its lead in S&E graduates, trademarks, technology balance of payments flows and medium-high and high-tech manufacturing employment. The US is slightly improving its lead in business R&D, EPO patents, (European Innovation Scoreboard, 2009 & 2010).

Table 2: Research Activity Index (RAI) in EU-15, 1996-2008

	Engineering	Physics, Astrophysic Astronomy	Mathematics, Statistics & Computer Sciences	Chemistry	Earth & Environmental Sciences	Life Sciences
Greece	+		+		+	
Poland		+		+		
Bulgaria		+		+		
Latvia		+		+		
Italy		+				
Slovenia	+			+		
Cyprus						
Turkey	+					
Germany		+		+		
Russia		+		+		
Estonia		+			+	
Slovakia				+		
Spain				+		
Czech Republic				+		
France						
Japan+			+			
Israel						
UK						
US						
Austria						
Switzerland						
Denmark					+	
Belgium						
Norway					+	+
Ireland						
Iceland					+	+
Finland						+
Sweden						+

Source: DG Research, Key Figures

The innovation and R&T performance for EU member states are the following (European Innovation Scoreboard, 2009 & 2010 and Innometrics 2009):

- There is considerable diversity in regional innovation performances. The results show that all countries have regions at different levels of performance. The most heterogeneous countries are Spain, Italy and Czech Republic where innovation performance varies from low to medium-high. The results show that all countries have regions at different levels of performance. Regions have different strengths and weaknesses. It can be noted that many of the "low innovators" have relative weaknesses in the dimension of innovation enablers which includes human resources.
- Denmark, Finland, Germany, Sweden, Switzerland and the UK are the innovation leaders, with innovation performance well above that of the EU27 and all other countries.
- Austria, Belgium, France, Ireland, Luxembourg and the Netherlands are the Innovation followers, with innovation performance below those of the innovation leaders but above that of the EU27.
- Cyprus, Czech Republic, Estonia, Greece, Iceland, Italy, Norway, Portugal, Slovenia and Spain are the moderate innovators with innovation performance below the EU27.
- Bulgaria, Croatia, Hungary, Latvia, Lithuania, Malta, Poland, Romania and Slovakia are the catching-up countries. Although their innovation performance is well below the EU average, this performance is increasing towards the EU average over time with the exception of Croatia and Lithuania.
- The most innovative regions are typically in the most innovative countries. Noord-Brabant in the Netherlands is a high innovating region located in an innovation follower country. Praha in the Czech Republic, Pais Vasco, Comunidad Foral de Navarra, Comunidad de Madrid and Cataluρa in Spain, Lombardia and Emilia-Romagna in Italy, Oslo og Akershus, Agder og Rogaland, Vestlandet in Norway are all medium-high innovating regions from Moderate innovators. The capital region in Romania, Bucuresti – Ilfov, is a medium-low innovating region in a catching-up country.

- Most of the changes are positive and relate to Cataluρa, Comunidad Valenciana, Illes Balears and Ceuta (Spain), Bassin Parisien, Est and Sud-Ouest (France), Unterfranken (Germany), Kzιρ-Dunαntϊl (Hungary), Algarve (Portugal) and Hedmark og Oppland (Norway).

Table (3) summarizes the changes in innovation performance for European regional groups. The performance results appear, between 2004 and 2006, the following 16 changes in group membership. Innovation is a priority of all European Union member states and various policy measures and support schemes for innovation have been implemented. Table (4) illustrates the dispersion of regional Gross Domestic Product (GDP) per inhabitant as a percentage. Dispersion of regional GDP at NUTS 2 level, calculated as the sum of the absolute differences between regional and national GDP per inhabitant, weighted with the share of population and expressed as a percentage of the national GDP per inhabitant. Finally, Figure (4) illustrates the prospects and the implications from European innovation policy of 3 % objective for the period 201-2030 towards the European competition vis-à-vis US and Japan. There is an apparently "innovation-gap" between EU and USA. In particular, in the fields of R&D the expenditures of public funding gap and the business funding gap amounts every year 25bn € and 105bn €, respectively. The estimated gains for the "3 % objective" until 2011 accounts around 0.25 % GDP every year and 2 million jobs for a period of four years, while after 2011 accounts around 0.5 % GDP every year and 400,000 jobs for every year.

Table 3: Changes in Regional Groups for Innovation Performance

Regions	2004	2006
BE2 Vlaams Gewest	High innovator	Medium-high innovator
DE26 Unterfranken	Medium-high innovator	High innovator
ES51 Cataluña	Average innovator	Medium-high innovator
ES52 Comunidad Valenciana	Medium-low innovator	Average innovator
ES53 Illes Balears	Low innovator	Medium-low innovator
ES63 Ciudad Autónoma de Ceuta (ES)	Low innovator	Medium-low innovator
FR2 Bassin Parisien	Medium-low innovator	Average innovator
FR4 Est	Average innovator	Medium-high innovator
FR6 Sud-Ouest	Average innovator	Medium-high innovator
ITG2 Sardegna	Medium-low innovator	Low innovator
HU21 Közép-Dunántúl	Low innovator	Medium-low innovator
PL11 Lódzkie	Medium-low innovator	Low innovator
PL31 Lubelskie	Medium-low innovator	Low innovator
PL61 Kujawsko-Pomorskie	Medium-low innovator	Low innovator
PT15 Algarve	Low innovator	Medium-low innovator
NO02 Hedmark og Oppland	Medium-low innovator	Average innovator

Source: Innometrics (2009)

Notes: Based on regional data availability the analysis will cover at most 201 regions for all EU Member States and Norway at different NUTS levels as follows (cf. RIS Methodology report):

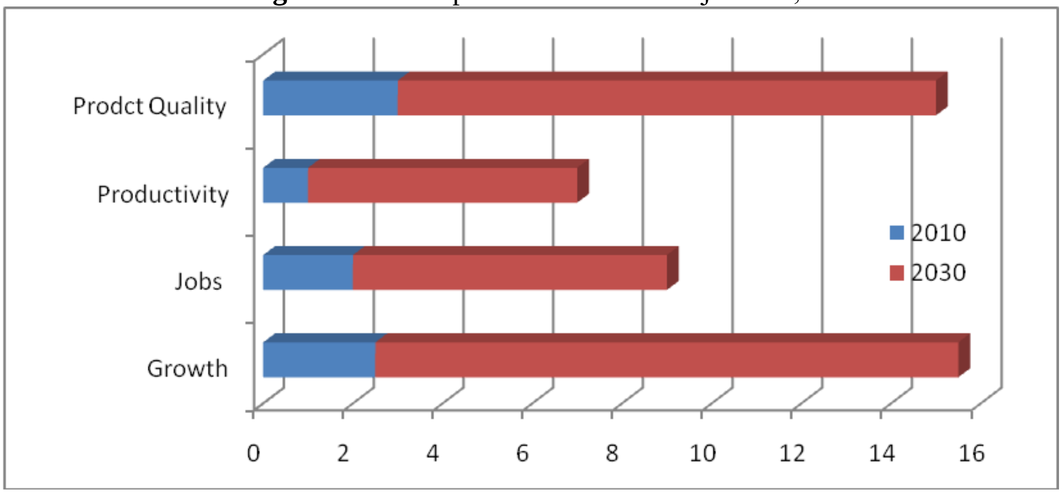
- NUTS 1: 3 regions from Austria, 3 regions from Belgium, 2 regions from Bulgaria, 9 regions from France, 9 regions from Germany, 3 regions from Greece, 1 region from Hungary, 2 regions from Spain, 12 regions from UK.
- NUTS 2: 8 regions from Czech Republic, 4 regions from Finland, 29 regions from Germany, 1 region from Greece, 6 regions from Hungary, 2 regions from Ireland, 17 regions from Italy, 12 regions from the Netherlands, 7 regions from Norway, 16 regions from Poland, 5 regions from Portugal, 8 regions from Romania, 2 regions from Slovenia, 4 regions from Slovakia, 17 regions from Spain, 8 regions from Sweden.
- 1 merged region for Greece (Anatoliki Makedonia Thraki GR11, Dytiki Makedonia GR13 and Thessalia GR14), 2 merged regions for Italy (Valle d'Aosta ITC2 and Piemonte ITC1; Molise ITF2 and Abruzzo ITF1), 1 merged region for Portugal (Região Autónoma dos Açores PT2 and Região Autónoma da Madeira PT3).
- Denmark, Estonia, Cyprus, Latvia, Lithuania, Luxembourg and Malta will be included at the country level.

Table 4: Dispersion of regional GDP per inhabitant as a percentage

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
EU-27	:	:	:	:	:	31,8	30,9	30,3	30,0	29,5	28,9
Belgium	25,3	25,2	24,3	25,2	25,3	25,4	25,4	25,0	25,2	25,6	25,5
Bulgaria	18,0	18,6	17,7	21,3	17,4	20,3	23,7	23,7	26,0	26,4	31,0
Czech Rep.	16,6	18,2	20,9	22,1	22,7	24,3	24,8	24,9	24,2	25,1	25,4
Denmark	:	:	:	:	:	:	:	:	14,4	16,3	15,7
Germany	17,0	17,0	17,2	17,5	17,6	17,9	17,9	17,8	17,6	17,3	17,3
Ireland	-	-	-	-	-	-	-	-	-	-	-
Greece	:	:	:	:	20,6	21,8	24,2	24,5	26,2	25,6	26,8
Spain	19,1	19,7	20,1	20,5	20,5	20,3	19,8	19,1	18,8	18,4	18,4
France	19,9	18,9	19,6	20,7	20,9	20,5	20,6	20,9	19,9	20,3	20,4
Italy	24,8	24,4	24,5	24,1	:	24,3	24,2	24,3	24,2	23,8	23,4
Hungary	27,4	28,7	29,2	32,1	32,6	33,0	35,4	34,2	33,4	35,7	37,6
Malta	-	-	-	-	-	-	-	-	-	-	-
Netherl.	10,3	10,5	10,7	10,8	10,9	10,9	11,2	11,0	11,3	11,9	11,7
Austria	19,3	18,5	18,5	18,5	18,1	18,4	18,7	18,0	16,8	16,9	16,1
Poland	15,4	15,8	16,1	17,7	17,6	18,2	18,1	18,3	18,7	19,4	19,5
Portugal	19,8	20,8	23,0	21,3	22,8	22,1	23,0	22,8	23,0	23,3	22,6
Romania	:	:	:	:	23,8	24,7	23,3	23,7	23,0	27,0	27,5
Slovenia	-	-	-	-	-	-	-	-	-	-	-
Slovakia	26,0	26,5	26,1	26,0	26,5	27,3	28,3	27,8	28,3	31,7	30,1
Finland	15,1	15,5	17,2	17,8	17,6	17,5	16,8	15,4	15,7	15,4	15,5
Sweden	12,6	14,4	15,4	16,2	15,7	14,8	15,3	14,8	15,6	16,4	15,3
United Kingdom	17,6	18,8	19,6	20,1	21,1	21,3	22,0	21,9	22,1	22,4	22,4
Croatia	:	:	:	:	:	17,8	18,0	18,3	17,6	19,2	19,1

Source: Eurostat

Figure 4: The implications of "3 % objective", 2010-2030



Source: Eurostat

The European innovation policy should facilitate the identification, adaptation and adoption of technological developments in a specific regional setting. It might be also facilitate towards technology transfer and the flow of knowledge across regions, maximising the benefit of the European dimension by facilitating access from less favoured regions to international networks of excellence (Stoneman, 1995). European innovation policy should take main actions, such as (Korres, 2011):

- Promoting innovation and introducing new financing forms in order to encourage start-ups, specialised business services, technology transfer,
- Interacting between firms and higher education/research institutes,
- Encouraging small firms and regions to carry out R&D for the first-time,
- Networking and co-operating among regions,
- Developing human skills.

4. Concluding Remarks

There is considerable evidence that investment in research and technological development and innovation (R&D) has a positive correlation with the level of economic development. Efforts in the area of R&D have been associated with higher growth rates, increases in exports and trade, gains in productivity, growth in income and output, higher business profits and international competitiveness. Given the correlation between innovation and R&D efforts and regional economic development, closing the inte-regional R&D gap in the EU becomes a requirement for reducing the cohesion gap, which is the primary objective of regional policy.

Most of the efforts in European innovation and R&D activities have been directly linked to the following policies:

- In the 1980s and 1990s, attention towards USA and Japan was put mainly in the Research Framework Program. The European research framework programmes have been launched to meet the specific needs of the weaker member states. Financial and technological flows through the research programmes should reduce the disparities between member states and to expand the opportunities for the European less favoured regions
- In 2000s, for EU attention was given towards competition with USA based in Lisbon strategy.
- Today, attention towards importance of ICT, sustainability, social innovation and demand pull measures

Looking first at scientific and technological output, EU is still ahead compared with US and Japan regarding the share of scientific publications, but lags behind in most of the other performance indicators, especially patents. There is, nonetheless, a substantial variation within the EU and certain EU member states often score better than the US and Japan (most notably Sweden and Finland). We can summarize some of the main findings:

- Per head of population, the EU generates fewer patent with a higher economic value than the US and Japan.
- The EU is lagging behind the US in patents in biotechnology and information and communications technology. International collaboration in patenting is lower in EU than in USA. In Japan, international co-operation in science and technology is rather limited.
- There has been a slight increase in the EU share of global exports of high-tech products in value terms.
- The production of scientific research and technological know-how increasingly depends on research conducted in other countries.
- In terms of scientific publications while actual numbers are still rising, however the EU share of world publications is declining, whereas the US share is recovering.
- Links between science and industry are not equally developed across countries.
- Technology policy has been relatively successful in certain fields like telecommunications or traffic control systems. In other fields, like microelectronics and computers, the results have been mixed.
- Less favoured regions spend comparatively lower levels of public funds on innovation and, on top of this, having greater difficulties in absorbing these funds than more developed regions within EU.

In the light of the above analysis, the European innovation policy has to be reinforced and oriented on several fronts:

- Establish a coherent innovation policy aiming towards industrial modernisation and competitiveness;
- Target and concentrated more effectively on the technological capabilities of the small member states targeting quality and productivity improvements and an exploitation of human and natural resources;.
- The traditional industries that are quite an important factor for the weaker states should be supported by appropriate research and technological programmes;
- The EU could envisage specific programmes for technological diffusion and dissemination of new technologies in small member states;
- Human capital formation should have a particular position in the EU policies *vis-a-vis* the smaller technologically countries. The European innovation policy aims to enhance the international demand

- for research activities and consequently to reinforce the weak internal market demand of the small member states aiming to regional convergence and a better quality of life.
- Investment in knowledge – research and development expenditure, education, software – and venture capital investment, for instance, spending patterns in the perspective of the knowledge economy.

References

1. Busom, I. (2000), An empirical evaluation of the effects of R&D subsidies. *Economic Innovation and New Technology*, 9, pp. 111-148.
2. European Commission: EU KLEMS Database.
3. European Commission (2009a) *European Innovation Scoreboard* (EIS), Brussels.
4. European Commission (2009b) *Regional Innovation Scoreboard* (RIS), Brussels.
5. Innometrics (2009), *Regional Innovation Scoreboard (RIS) 2009*, by Hugo Hollanders MERIT1, Stefano Tarantola – JRC2, Alexander Loschky – JRC2.
6. Korres G (1996) *Technical change and Productivity Growth: An empirical evidence from European countries,* Avebury Ashgate publishing, London.
7. Korres G. (2011) *Handbook of Innovation Economics*, Nova Publishers, New York.
8. OECD, STAN and National Accounts databases.
9. Pavitt K. and Walker W. (1976) *Government policies towards industrial innovations a Review*", Research policy.
10. Stoneman P. (1995) Handbook of the Economics of Innovations and technological change, Blackwell, Oxford