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The European Network State and the Weak Southern Link

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ABSTRACT

The purpose of this thesis is to investigate how networking can help less developed countries to develop in a new changing environment and minimise the gap through their increased participation in networks. The study investigates different collaborations in R&D in governmental, educational and business sector. The research methodology adopted, examines the process of structural changes and policy implementation towards the targets set by the EU and how this is shown in network participation. The network formation within the European Union is analysed and is evaluated in comparison with the steps taken by the southern countries Greece and Spain, and partially Portugal, in relation to convergence, innovation and network adaptation. The theoretical framework used is the Actor Network Theory together with the Triple Helix model in order to stress the interconnectivity of all the actors involved and show the important role of the universities. It was found that the limited participation in networks reflects the economical position of the country, its developments progress and the level of innovation diffusion. Institutional changes are of great priority in southern countries and have to be followed by the increased involvement of universities, and other actors, in the economical development of the country that heads towards a knowledge-based society and economy.

Key words: Networks, European Union, Knowledge-Based Economy, Innovation, Research and Development.

CHAPTER 1 - INTRODUCTION

1.1 Background

Our beautiful, unique and precious world has never been equal. Throughout the human history access to resources allowed some groups to develop more that others and consequently, to dominate for a period of time. Nowadays, the same story keeps taking place, people, nations and states fight for access to resources and markets. But the objectives have slightly changed today; access to knowledge, research and development (R&D), innovation and sustainability are considered the keys for progress in the current information era. Europe has always been the centre of brutal confrontations and at the same time pioneer in the discovery of new resources. Various nations have managed to dominate and influence others during the past, but the decline of all the civilizations unavoidably meets all developed societies, as history has demonstrated. During the last centuries, northern European states have managed to dominate; not only the Europe continent but the whole world. The decline of by then of the developed southern countries came as a consequence. Nowadays though, there is not such a violent competition among the European countries. Nations fight for integration and convergence (Kaitila, 2004; Martín and Sanz, 2003; Karras, 2001). The process towards the real convergence between northern and southern Europe is the main concern of this paper.

In any case, as the world, the society and technology are changing, new terms and words are evoking in order to describe the complexity of the new shaped reality. In the information era, in a globalised economy, “networks”, as a term, is used to characteristically portray the human and non-human interactions. It is currently the most popular and most explanatory term to describe the interrelated elements found within the societies and the economies in the world, after the invention of computers.

> "*As we are entering the information age, the space of flows dominates over the traditional space of places, and everything which is relevant for people has the trend to organize through networks“, (Castells, 1996).*

Networks became a prominent term to interpret the transformation taking part in the economies and an important tool in the hands of the companies to establish their presence in the global market. Currently, the process towards the real convergence in

Europe Union (EU) between north and south is the main concern of all member state and the way it is accomplished is the main target of this master thesis. Thought this analysis is pursued a model for the successful implementation of the acquired knowledge, to the southern European Union and especially to Greece, Spain and partially Portugal, who present similar characteristics towards their effort for real convergence with EU. The information era is a matter of fact and fast adaptation in the new reality determines the success of the process.

Manuel Castells (1996) in the book, “The information age” describes how the informational capitalism spreads around the globe. However this spread is unequal and not everybody benefits from this fast expansion. Indeed, the above mentioned countries, even though developed, are far behind in comparison with the rest member states of the EU. Talking about the major urban and industrial territories the scale of development is higher of course, but other regions are excluded from the overall developmental design of the new changing, informational world. This development of informational capitalism appears to have “black halls”, as it wisely is described by Castells, and social exclusion is taking part into spatial terms. The territorial confinement of populations, who are disconnected from the functional networks, is according to Castells, an important characteristic of the spatial logic of the network society and the informational capitalism.

On the road to the next step of the network society, Castells provides a description a new network state, the European Union. The unification of Europe is providing the best example to describe the new changing world. The road towards European integration, apart from trying to prevent a new war, has lots of technological and ideological ambitions. Its great economical and technological potential, its cultural and political influence, its polycentric structure will transform this Union into a world power and a big centre of influence. Moreover, this union is more significant as a source of institutional innovation, where transformations are seen in terms of government forms; new institutional forms of governance in national, regional and local level take part and constitute what Castells describes as the “Network State”. This potential and transformation in Europe though is an effect of the new informational area, characterised by the globalisation of the economy, of the technology and the communication. Within all of those transformations of the society and the world, the European Union adopted new processes, new institutional system, and new tendencies which will lead it to become a “Network State”. But this

transform is not equivalent and transformations do not follow the same trend in all Europe and the results are obvious, with some countries trying to catch up.

> "*The idea of creating a union started to take form in the 25th of March in 1957 in Roma where it was agreed the creation of a common market of coil industry. From then lots of countries have entered the union and its form has change continually with more integration among the states taking part by establishing a common market of capital, goods, services and employment and heading towards political integration. The great step towards that target was achieved with the introduction of euro and the creation of the European economic union. The entry of richer and more developed states like Austria, Sweden and Finland balanced the entry of southern poorer countries (Greece, Spain and Portugal). Following with the entry of the eastern countries various future problems, like immigration, political conflicts, could be avoided and be continued by the expansion of the common market to more regions and people, especially with the entry of Poland*" (Castells, 1996).

The process of European integration is a reaction to globalization in its more advanced expression. It is wisely designed and based in regional structure functions together with the old national institutions and the new trans-national institution which provide organization about the economical competition. However, the past technological policies of Europe have fail, with exception the aeronautic sector, and especially lost the competition with USA and Japan in the sector of microelectronics, with exception of Nokia Company and Finland (Castells, 1996). The EUREKA program tried to stimulate advanced companies to cooperate in Europe, with limited results in the past, but with lots of lessons learned and with even more anticipation for the future. Companies now can not work alone and cooperation is offered as a one-way exit. The single market is not enough though; enterprises with advanced technology are dependant in the word market and the technological and economical exchange. Dependency to electronic component and computers made impossible to establish European technological independency and consequently, the above facts led to the creation of the "Network Company" within the network state (Castells, 1996).

The above conjecture will start taking a clear form and shape as the arguments of this paper will approximate the conclusion, to picture the whole shape of the web

of nodes and its interaction and provide a proposal towards the real convergence and development of all in the European Union (EU).

1.2 Aims and Objectives

The purpose of this thesis is to analyse and investigate the development of networks in the society and the economy from various perspectives, and furthermore provide fertile ground and valuable analysis of the European regions and policies in order to offer opportunities for better interpretation of the complexity the *concept of development* implies in the new changing world, over the different European countries, with an eye to the overall European development. Its focus is bounded in the countries of southern Europe, (Greece, Spain and partially Portugal) and their effort to bridge the gap between south and north in the modulating *knowledge based economy* through the understanding and application of various types on networks.

The utilisation of various materials and views will intent to give a multi-perspective of the current process of development and convergence, between the less developed countries in the south and developed countries on the north, but mainly to the overall European policy in science, technology and innovation. The analysis is expected to be especially beneficial for less developed and less industrialised countries into the EU and especially for Greece, Spain and Portugal. The role of university as a key actor within all those processes is stressed. The approach of technological change from the Science and Technology Studies (STS) perspective can assist to realise the complexity of the process and redirect the focus into more vital and important issues which will help to implement appropriate policies for better knowledge and innovation diffusion.

1.3 Science and Technology Studies (STS), Innovation and Development

The entry in the information era and the emergence of internet and telecommunications has transformed our societies and economies. Not only the new technologies have transformed our societies but the overall reaction of all the relevant actors contributed in the formation of the new reality. Citizens, governments, universities and private sector confront new challenges daily which are demanding their collaboration and contribution for a sustainable and equitable development. The European Studies on Society, Science and Technology (ESST) stresses the interrelation of scientific, political, technological, societal, and economical issues,

among others, and intends to introduce an *interdisciplinary view* when decision makers search for solutions in the modern cultures of innovation. The aims of the ESST are the political and cultural analysis of the modern knowledge society, the social and economic analysis of the innovation cultures and the reflection of scientific and technological development. Towards a multidimensional framework of analysis and with an eye to the ESST objectives the present thesis will move, in order to contribute to the understanding of the complexity of those interactions in a fast changing, innovative and globalised world, and furthermore stress the importance of networking towards this process. ESST is a pioneer who sets the right framework in which all the type of relationships in the society can analysed and understood. Existing economical, scientific and technological divisions in Europe need to be diminished. ESST is part of that movement which invests in knowledge exchange, innovation and sustainable development, with respect to plurality, collaboration, freedom of thought and participation of all relevant actors. By assuming that innovation and technological change are social processes and not simply technical, ESST commence the need for a multidisciplinary approach in its study. Consequently, in order to understand the evolution of science and technology you need to think all the relevant social and economic circumstances before decision making.

1.4 Topic and Purpose

During the past, many attempts to lessen the gap between developed and less developed economies have been made. Today is more evident than ever before. This process is global, but within Europe, the intensity of the effort towards that target, offers a distinctive position of the EU globally. The aim of the programmes that the EU applies is to give the opportunity to all members, and more to poor or isolated regional communities to improve their income and increase their access to technologies and knowledge. This process though has not the same results in all the countries, neither all countries work with the same willingness to complete the targets set. As a consequence, different developmental speed is observed in Europe after the adoption of Euro and through the recent entry of ten new members with low GDP (Gross Domestic Product) per capita in 2004. Terms like two-speed or tree-speed Europe arose in order to describe the variation in the developmental attempts taking part within the EU. Within this reality, different developmental speed is observed in the “old Europe” too (EU-15). The southern

countries, Greece, Spain and Portugal, have managed to decrease the gap with the northern and more developed courtiers but still there is lot of job to be done in order to eliminate it in order to form part of the high-speed Europe. (Italy does not fall within the same group, as its participation in the formation of EU since its foundation has allowed the country to develop much more than the rest southern countries and form part of the leading countries in the EU). *An this light, the purpose of this thesis is to analyse the network structure within the European Union and evaluate the steps taken from the above mentioned southern countries in relation to convergence, innovation and network adaptation.*

1.5 Research Questions

In order to study the process of convergence, knowledge diffusion and innovation in Greece, Spain and partially in Portugal within the EU the research is guided by the following questions:

- *Does the increased participation in the network structures of the EU helps the countries to achieve faster levels of development and convergence?*
- *Why is it observed slower adaptation in the EU's strategies and targets by the counties of the south? Does the limited performance observed could be explained by the poor cooperation between universities/government/companies (the Triple Helix)?*
- *Could universities and networking give a push to the southern countries towards the knowledge-based society and better innovation diffusion?*

The approach adopted will examine through comparison with developed countries, the process of structural changes and policy implementation towards the targets set by the EU. As those countries have received economical support through a number of years, Greece since 1981, Spain and Portugal since 1986, and still have not achieved the expected results towards convergence a *policy question is raised here*. Does the followed policy work properly and if not could that have implications for the twelve new member states in the Union?

1.6 Significance and Limitations

The central hypothesis of this research is that in order to achieve the targets and objectives set in European, national and regional level it is necessary to activate all the relevant actors of the society and mobilise all the resources in the form of a network, especially the universities. This will guarantee an interactive perspective on the objectives set and will allow other professionals to contribute towards the achievement of a target that is not only economical. The hope is this mobilization of all the active members of the society will create a wave of awareness and participation that will lead to acceleration of the societal and economic change in those countries and all Europe.

Although, this paper is concerned with development in southern countries of Europe, it is not limited only in the diffusion of knowledge in those countries. The model of those countries, and the policies of technological and institutional change can be applied and inspire the newcomers in the European Union, as an example, whom still have lot of way to go. Though, this paper does not claim to give a solution to the overall and complex problem of development in Europe but to move towards its solution. It analyses the structure of the overall attempt, in European and regional level and attempts to report the lessons learned from the application of different policies in the states. Moreover, it does attempt to identify and promote the interconnectivity between the various elements, and stress the need for strengthening the connections between them. The current demand of the society is collaboration and networking. EU has to achieve the maximum degree of networking in all its regions, as only like that will achieve the improvement of its citizens well being, gain faster economical development and become a global economical power and as a consequence a role model of economic and social networking with all the actors involved. Based on an old popular proverb which is attributed to Vladimir Lenin and says that “the chain is as strong as its weakest link”, we have to involve all relevant actors and strengthen the interconnections between them.

1.7 Research Methods

In order to study the process of convergence, development, technological change and policies, the diffusion of knowledge and innovation, the research bases its comparison between EU and Greece, Spain and partially Portugal. The approach adopted examines in depth the process of structural changes and policy

implementation towards the targets set by the EU with a focus in networks. In order to carry out this comparison are used the international standard and indicators set by the Organization for Economic Co-operation and Development (OECD). In addition, the employment of the monthly measurements and observations from the European organizations (EuroStat, EuroBarometer) make this comparison possible. Opinions and observations of the mass media in the current countries were taken into consideration in some cases, as an attempt to shade the effects of the current changes to the society from a general view point. Newspaper articles, conference reports, ministerial reports, thematic conference reports were also employed as a source of a more specialised view point. It has been made an effort to construct a way of discourse, as many before, through various sources (OECD, United Nations, World Bank, EuroStat, government offices, academic sources) of which their data are broadly acceptable from the scientific society and investigators.

1.8 Thesis Structure

Once the introduction and the motives behind the present thesis will have been explained in the first chapter, it will be presented a short illustration about networks in general and their role in the society and economy in the second chapter. Following, the theoretical framework of the analysis will be depictured in the third chapter. The purpose of the forth chapter will be to outline the major actors and their course of action towards the creation of the Network State and the knowledge-based society in Europe. Finally, the fifth chapter will provide the author's judgments and conclusions as regards to the topic.

CHAPTER 2 - NETWORKS AND ECONOMICS IN SOCIETY

2.1 Concept of Networks

Before we will focus in networking in the EU it is essential to see networks within its natural environment, economics. The descriptive context of the following chapter is necessary in order to understand the function of networks and picture the framework in which the economical interactions in the modern society occur. According to Castells, the new economy is informational, global and connected in networks. It is informational because the productivity and competition it is based in the capacity of

units to generate, process and applies the information based in knowledge. It is global because the production, the consumption and the circulation are organized in a global scale. It is connected in networks because the production is generated and the competitively is developed in a global network of interactions between business-company networks (Castells, 1996, p. 111). The connection and interaction of all the above together with the features of the new economy, based on the informational revolution, creates the most prominent features of the network society and its evolution based on the knowledge-based economy.

Starting the complex exploration of networks we have to consider at first the concepts which give importance to the emergence of networks nowadays. According to Castells those are: knowledge, technology and innovation. Briefly, *knowledge* is the structured information on know-what, know-how, know-who and it may be tacit or codified knowledge, embedded in individuals, organizations, (formal) institutions, physical structures. *Technology* is a set of pieces of knowledge, both directly "practical" (related to concrete problems and devices) and "theoretical" (but practically applicable though not necessarily already applied), know-how, methods, procedures, experience of successes and failures and physical devices and equipment (Dosi, 1982, p.151). Following, *innovation* is the creation resulting from study and experimentation leading to a new device or process. Finally, the general concept of *network* is interconnected systems of things or people, characterized by flows of information, people and money among various, relatively fixed, entities. Now, we will see how economists define networks, a social and economic phenomenon that cannot be considered as new, as the earliest documentation of networks goes back to the Renaissance and the Medici family (Kent, 1993).

> "*A network is a select, persistent and structured set of autonomous firms, engaged in creating products or services based on implicit and open-ended contracts to adapt to environmental contingencies and to coordinate and safeguard exchanges*" (Jones, Hesterly and Borgatti, 1997).

At this juncture, Jones, Hesterly and Borgatti (1997) by saying implicit and open-ended contracts mean formal (legal, codified) and informal (social, tacit) contracts. Implicit and open-ended contracts are usually found in clusters of industrial activity, e.g., Silicon Valley (it will be presented in detail further on), but there are

also "low-tech" examples of networks of firms. Following, a second definition is provided.

> "*Networks are the essential means of linking one group of agents to others whom they affect. They are the intricate links based on trust and reciprocal patterns of communication and exchange between producers and clients that are necessary to ensure an economic capability and responsiveness in support of business development*" (Grabher, 1993).

Most networks operate based on a combination of formal and informal agreements. A small innovative firm can benefit from a larger firm's financial resources and market access. A large number of small firms will benefit from collaborating due to creating a critical mass in terms of collective resources, complementarity, and market access. The key questions here is why do firms collaborate and why should we study networks. The answer is given by Walker, Kogut and Shan (1997) who state that "*Network structure indicates both where social capital is distributed and where opportunities for entrepreneurial action are located*" meanwhile Levinthal and Marsh, (1994), says that because "*Exploration is costly, often unfruitful, but the only way to finish first*". Here need to be added that from the current trend networking is the answer of certain industries to the challenges and opportunities of globalization.

March (1991) view of networks offers two key terms: exploration and exploitation. Because of these factors (bullet points), firms need to become parts of networks to explore and to exploit more effectively. Exploration determines the firm's decision to innovate or imitate. The need to explore is particularly pronounced (intensive networking) among firms involved in industries with increased product complexity, increased uncertainty in R&D efforts, increased cost of R&D, shortened product life cycles and in order to gain market access. So firms mainly collaborate because complementarities in resources, risk sharing in R&D, cost sharing in R&D, knowledge spillovers and organizational learning, where diversity equals strength (March, 1991). The most productive networks in terms of innovation tend to be the

most diverse ones. In Figure 1 below it can be seen the increase of R&D collaborations among firms[1].

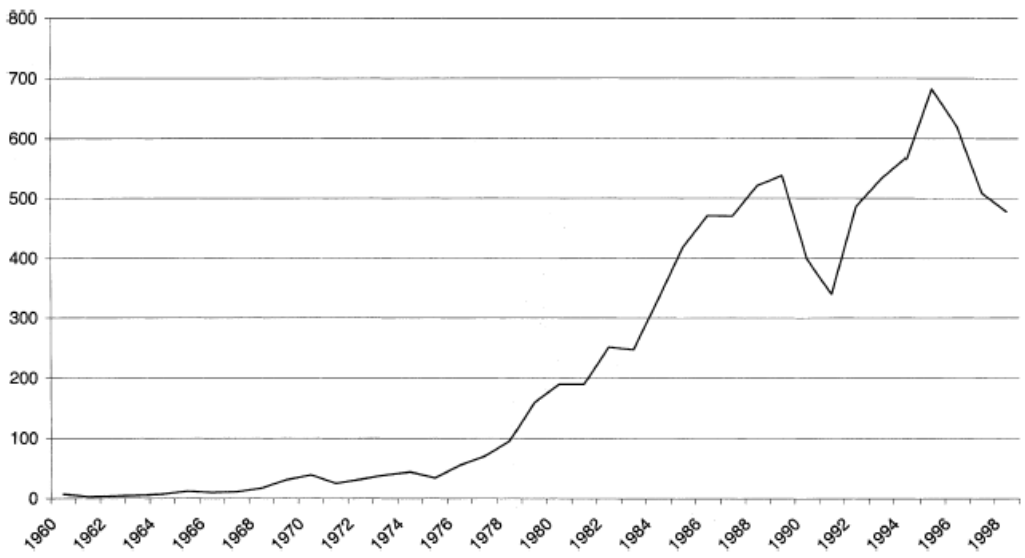

Fig. 1. The growth of newly established R&D partnerships (1960–1998).

2.2 Types of Networks

One popular way to explain these developments is to look at the interconnections among firms and the trends that come into sight. The structure of a system determines the outcome and the performance of the network. It can be found fully connected, partially connected, tree-structured, star, ring or double link networks (Figure 2). The firm's position in the structure determines the opportunities and the constraints the firm will encounter. How good this information could be is analyzed and investigated by a new field of research called *network analysis* which investigates and measures the flow of information, money and people within the network or a combination of the above, particularly the weight, the core-periphery and the clique (Wasserman and Faust, 1994), (Figure 3).

[1] Source: MERIT-CATI Database (Duysters, and Hagedoorn, 1993; http://www.merit.unu.edu)

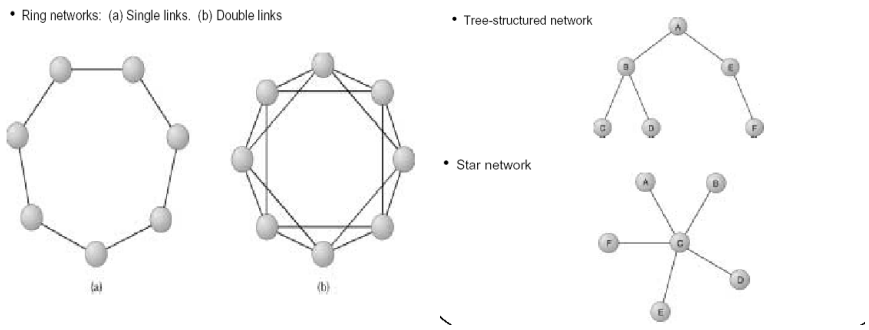

Figure 2: Network structure: fully and partially connected, tree-structured, star, ring or double link

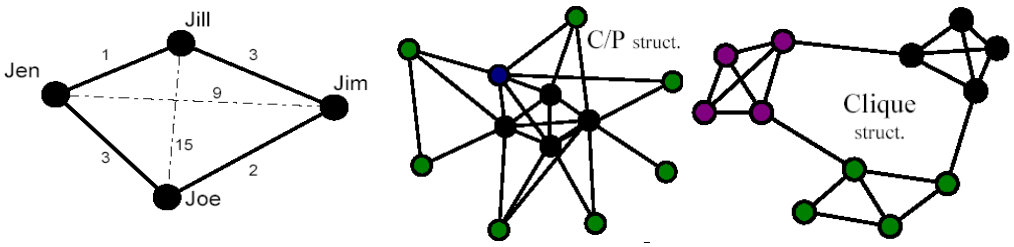

Figure 3: Network structure: weight of the core-periphery and the clique

The numbers between nodes (Figure 3) indicate the weight attributed to the link based on frequency of interaction or closeness. In Figure 4, the social capital in each clique is high as can be seen from the number of connections. But, the social capital in the whole system is not as high as it could be as the red node is only connected in one clique. The issue for the red node (firm) would be to find out what information the other two cliques have to offer, get this information and use it for its profit with the other two cliques. Through that way the red node (firm, person, university or even states) increases its access to information and strengthens its position by providing information to the other cliques in return, as there is no direct connection between the cliques. Let's see what trend come out from this formation[2].

[2] http://www.insna.org/

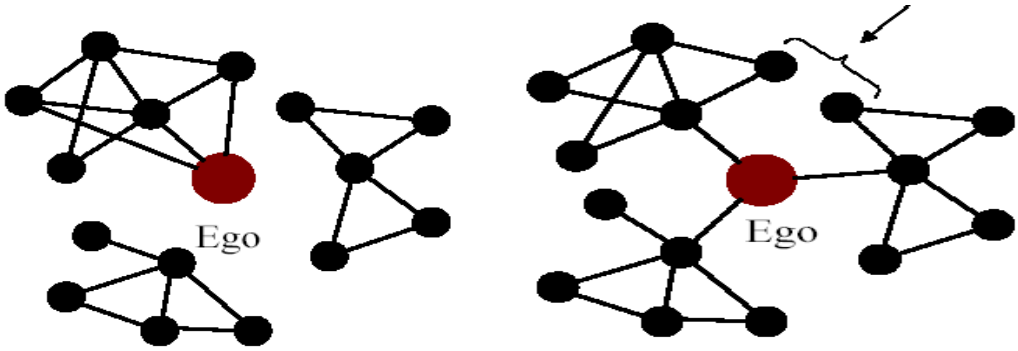

Figure 4: Structural holes and profit making from the privileged position of the firm in the network

2.3 Function of Networks

The formation of the network depends mainly on the type of industry and the objectives of the firm. But first let's analyze that in detail once we have introduced two new terms, social capital and structural holes. By the term *social capital* is the advantage created by a person's location in a structure of a network. With that term, it is meant the cohesive ties among the actors, frequent interaction, thick information exchange, trust, and longevity of relations (Burt, 1997a; Burt, 1997b). Social capital is the contextual complement to human capital. The social capital metaphor is that the people who do better are somehow better connected (Burt, 2000). There are widely shared mental models and codes of conduct relating to information exchange and the distribution of tacit knowledge is not always even.

> "S*ocial capital is the sum of the resources, actual or virtual, that accrue to an individual or group by virtue of possessing a durable network of more or less institutionalized relationships of mutual acquaintance and recognition*" (*Bourdieu and Wacquant, 1992).*

The underlined aspects of social capital within the network have to do with the number of collaborators mainly, the more the better. On top this lead to better and more variable ties and offers better opportunities in managing diverse R&D ties with cost reduction benefits, by building in social capital. In their analysis Bourdieu and Coleman (1991) gives the characteristics and features of networks based on social capital. There are mainly closed networks which enforce restrictions in order to solve the "free rider" problem. Free riders are actors who consume more than their fair

share of a resource, or they shoulder less than a fair share of the costs of its production. The free rider problem is the question of how to prevent free riding from taking place, or at least limit its negative effects. This could be compared with the attitude of some poor countries in the EU, who believe that can only get benefits and money from the EU without carrying out any investment. Europeans believe that those countries want only to get financial support and economical benefits but they do not want to invest. For example the results of long-lasting support and assistance in southern countries have not been shown yet. The social capital enforces trust creation which is vital for success of the network.

On the other hand, may be *structural holes* in the network, leading to network inefficiencies (due to information asymmetry) or competitive advantage (due to increased number of opportunities). Burt (2000) describes structural holes as holes between the dense regions of networks. Structural holes have fewer redundant ties where the actors intent to position themselves into the structural hole in order to increase their benefits based on their privileged position. Here the opportunities for entrepreneurs arise between cliques of networks, not within, and there are more opportunities to select partners. Structural holes can be fixed through intervention by firms or other actors, for example the government or the EU. The structural hole argument is that social capital is created by a network in which people can broker connections between otherwise disconnected segments (Burt, 2000). Some examples include the "Toyota case" (Dyer and Nobeoka, 2000) and the "Biotech case" (Powell, Kogut and Smith-Doerr, 1996). Toyota built the social capital of its network of suppliers by drawing them in through public relations, incentives, and networking. Arguably, what Toyota accomplished was done with the help of government, directly or indirectly. The network of suppliers was formed by force and Toyota Company was the dominant leader of the network. The incentive was the need for distribution of tacit and explicit knowledge in order to enhance organizational learning throughout the network. The biotechnology industry, or steel and semiconductor industries, is an example of clustered activity. Networks here are formed by necessity in order to compete with other networks.

> "*In industries in which know-how is critical, companies must be expert at both in-house research and cooperative research with such external partners as*

universities scientists, research hospitals, and skilled competitors" (Powell, Kogut and Smith-Doerr, 1996, p. 119).

2.4 Problems with Network Function

Some problems that arise from the networks, is how to motivate the members, as firms tend to keep their knowledge to themselves, the free rider problem, how to maximizing the transfer of knowledge and furthermore, how to sustain the network and find the right collaborators. That is why various researchers have stressed the importance of *embeddedness* for better economic performance. Embeddedness refers to the process by which social relations shape economic action in ways that some mainstream economic schemes overlook or misspecify when they assume that social ties affect economic behaviour only minimally or, in some stringent accounts, reduce the efficiency of the price system (Granovetter, 1985). As stronger the ties between firms within a network makes easier the transfer of tacit knowledge and undermines contracts. On the other hand, Williamson (1994) argues that "although the concept of embeddedness is useful for understanding the sociological failings of standard neoclassical schemes, it does not explain concretely how social ties affect economic outcomes. The core statement, that economic action is embedded in social relations which sometimes facilitate and at other times disorder exchange, is conceptually vague (Uzzi, 1997). It forestalls a clear comparison between the refutable propositions of current theories and the broad statements describing how embeddedness shapes personal motives and collective order". Research though, is undergoing in order to specify how embeddedness and network structure affect economic behaviour (Uzzi, 1996, 1999).

As the theoretical debate continues to solve question about the governance of networks, the boundaries of networks, the evolution of networks and the relation of networks between network and the "construction" of technology, the morale coming out of the new informational era is the eliminating your competitor means removing a collaborator and, thus, opportunity (Hagedoorn, Link, and Vonortas, 2000; Hagedoorn, 2002). However, keeping in mind that the strength of networks stems from diversity, unavoidably the question of how to keep network collaborators from becoming similar is evoking.

Within this structural change and the new technological and organizational paradigms have been created the new "network enterprises", which need the support of the local and regional governments in order to have synergetic effects and establish the means of innovation (Castells, 1996). In order to make reality the potential of the technology, states have to forgone a reorganization of the current institutions. It has to be changed the way knowledge is applied and the management of the technology in made. The impressive change observed in USA, EU, Japan and other leading economies has to do with the structural changes in the economy and the societies in the way they integrate in the transition to a new way of development, the informationalism (Castells, 1996). Smaller or developing economies inevitably are required to move towards replication of successful models to achieve learning and economical development.

2.5 Network Notions to Explain Innovation

Castells' network company though it is not an enterprise network. It is a network done of companies, segments of companies or internal division of companies. Big companies are internally decentralized meanwhile small and medium companies are connected to networks assuring their survival, their contribution and their flexibility at the same time. An example is the technological alliances that are tied in order to make certain projects and they are reshaped again for new project. It is the new capitalism that depends on the innovation like sources of the productive growth, structured global financial markets by means of the computer science network, of networks of production and management, internal and external, local and global and with a flexible and adaptable employment. The power to gain control upon the others in the network depends on the possibility of programming and of re-programming the networks according their objectives and the ability to connect different with different networks in order to ensure cooperation, and sharing common resources. Recently, various collective actions and social movements try to introduce new codes in the programs of the networks (Castells, 1996). Towards this process have been taken steps and initiatives started within and outside the EU to help companies to develop and overall help the European economy.

Two examples of technological innovation, networking organization and economic productivity are famous and serve as successful models, Silicon Valley and Finland. The characteristics of Silicon Valley are cultural and institutional diversity,

synergy and geographic coincidence between raw materials, capital and skilled labour. The help and driving finance from the military was the key to start a culture opened to innovation and talent. Nowadays the driving force is the interest in technological innovation and its applications into society. Universities, lawyers and risk capital played are the other actors who help a lot the growth of the Silicon Valley model. Based on the company network certain companies were dedicated to innovation meanwhile they were subcontracting others for them. The crisis to the Silicon Valley model was provoked by the bankruptcy of the companies dot-com but the innovation is still on and the growth on productivity remains (Castells, 1996).

On the other hand, the Finland Model is based on the Nokia firm as the nucleus of the telecommunications industry with over 300 companies associated with the firm. With institutional support and governmental assistance this model is based on the human talent, in the finance of risky projects and in innovation culture. The development is inclusive, extended in the whole society and the improvement of the well-being. It can be found less risk capital than Silicon Valley though and a hacker culture within that model, e.g. the invention of Linux. Contrary to the Silicon Valley model, policy in immigration is very restrictive and meanwhile the finish talent is difficult to be kept within and as a consequence it is observed a large transference of Finnish talent around the world. Europe tries to keep their talent in Europe and stimulate them to become more innovative than anyone by setting very prosperous targets and take measures towards it (Castells, 1996).

Various models and information have been provided of which all point towards the same direction. Coordination and networking is the demand on the network society. If you want to innovate, develop and produce more you have to wire together in networks. The implications of the network models applied, like Silicon Valle, Finland, Toyota and Nokia is high flexibility, adaptability and cooperation in order to innovate and survive. The transformation in the network economy is rapid and there is not enough time to be lost. Organizational and institutional changes have to be promoted fast in order to give flexibility to the economies and the companies to expand, where innovations can easily arrive in the market. The research cost is reduced and everybody can take part on the mutual opening and free access of information where all can have benefits.

CHAPTER 3 - THEORITICAL FRAMEWORK

The theoretical framework used to analyse the interacting heterogeneous elements composing the process of technological change, the innovation diffusion and the network that connects it all, is the Actor Network Theory (ANT), developed by Bruno Latour (1987), Michel Callon (1986) and John Law (1987). In ANT the human and non-human actors are linked by diverse connections composing the network architecture (Law, 1999) and its emphasis is on the movement and the dynamic interactions between those heterogeneous actors. Any particular technological change is the result of negotiations among the actors. It is predominantly important to identify the enrolled actors, classify the *different level of power* each of them holds and their *diverse interests*. The notion of power is very important for the structure of a network; it can vary along time and influences more than anything else the relations among the involving actors. For example, citizens and ministers hold different attitudes and positions towards particular decision-making processes, but both form part of the network. However, the opinion of the citizens has more weight only when the elections period is approaching.

2.1 Actor Network Theory

The interactive heterogeneous elements found during the technological change and innovation can be well described by the Actor Network Theory. ANT emphasises on the dynamic interactions between heterogeneous actors such as humans and non humans related into a network that provides a wide range of connections and interactions (Latour, 1987; Law, 1999). Likewise, in the diffusion of knowledge in the EU there is a wide range of actors involved of which their influence affects the overall development, either as a result of negotiation or political choices and strategies. The interests and the power of the actors direct the track and the speed of the technological change and development. EU, governments, firms, universities, agencies and local population are some of the actors involved in the technological change and development. The ANT will help to understand the power and interaction of institutional frames that influence technological change within the network on one hand, and on the other the interest of the governments to promote changes and the

dynamics unfolded. ANT, developed by Callon (1986) and Latour (1987), first created in order to understand the processes of innovation and knowledge creation in science and technology. Based on the material-semiotic method tries to plot the concurrent relations between materials/things and semiotics/concepts. The interactions of these human and non-human actors form an exclusive network. In this regard they investigated large technological developments through empirical case studies in an attempt to inspect political, technical, scientific, legal and organizational factors influencing that process. The analysis passes through a series of concepts.

a) The central concept of *translation* at first pictures the attempt of innovators to create a debate in which the actors build a network worth defending (the European Union in that case, for the knowledge based economy and innovation). Callon (1986) identifies four moments of translation. The first pass is the *problematisation* in which is identified the problem to be solved and the relevant actors. The primary actor becomes indispensable (EU and European Commission (EC)) as establishes itself as the obligatory passage point for the rest of the actors. Second, the primary actor through the pass of *interessement* is negotiating the involvement of the rest (the entry requirements in EU) and convincing them for their role of their enrolment (a delay on the process of convergence in observed in the EU though). The third pass is when actors *accept the role* assigned to them. Lastly, the *mobilisation of allies* pass concerns the question if the delegate actors in the network represent the vast majority of the groups, which ensures the active support (e.g. mobilization of business sector and universities).

b) The principle of *generalized symmetry* is the next fundamental concept which ensures that all the elements in the network are described in the same terms and all differences are generated in the network of relations (common language, indicators, EuroStat etc).

c) *Actants* are human and non-humans actors in the network of which their role is indicated by the relation between them. They are all enacted alliances and all lies within the network of relations between them, as all have the ability for interaction; human, non-humans or technologies.

d) *Punctualisation* is the concept that any actor is a sum of other smaller actors and all together need to function together in order to achieve a target (the triple helix model). If all the actors do not act *synchronised* then the actor network will brake down.

e) The successful interaction between the actor networks it is transferred in the network through *tokens or quasi-objects.* The transmission of tokens brinks punctualisation and reification in the network, but when its frequency decreases it brings the opposite effects in the network.

In the current analysis will be presented all the actors and elements based on ANT and with its help we be stressed the importance of universities in the whole process of development in science, technology and innovation.

2.2 The Triple Helix

Other theories could also be useful to conduct this analysis as there are various emergent new conceptual frameworks for innovation policy. This has to do with the evolutionary economics (Nelson and Winter, 1982) and the technological paradigms (Dosi, 1982), the national systems of innovation (Freeman 1987, 1995; Lundvall, 1992; Nelson 1993; Edquist, 1997) and the Triple Helix of University, Government and Industry (Etzkowitz and Leydesdorff, 1995, 1997). In this research we will also focus at the last one as the key motto for Europe and OECD countries is the knowledge-based economy and society. Knowledge is no longer an individual property and this makes the difference in our society, as the position of the sciences in society has changed, new transformations affect the production of scientific knowledge by providing science with new applications contexts (Gibbons, Limoges, Nowotny, Schwartzman, Scott, and Trow, 1994). The interdisciplinary researchers Etzkowitz and Leydesdorff (1998) identify that the character of the competition among nation states has been networked in terms of mandates for regional and supra-national institutions (e.g. at the level of the European Union, the International Monetary Fund etc.) and this has transformed the matrix of disciplinary and institutional organization among and within the sciences. In continuation, they argue that universities and firms today are assuming tasks that were formerly the province of the other and so on; the boundaries between public and private, science and technology, university and industry are in flux. There is an increased reliance of industry on knowledge originated in academic institutions (Etzkowitz, Webster and Healey, 1998), as university as a knowledge-producing and disseminating institution plays a larger role in industrial innovation. Therefore, the university nowadays crosses the traditional boundaries and develops new linkages with industry; it devises formats to make research, teaching, and economic development compatible (Etzkowitz and

Leydesdorff, 1998). The arguments of the above researchers underline the escalating importance of networking in all the society, towards a knowledge-based economy.

In the knowledge-based economy, university is a human capital provider and seedbed for new firms and therefore the third mission of the university is to cooperate with organizations, companies and individuals, and contribute in the regional development, usually encouraged by government, at national or regional level or even by multi-national organizations (Etzkowitz and Leydesdorff, 1998), as it is a fundamental source of knowledge and technology. Knowledge has become a potential product that can be exploited on the market, which means the industrialisation of the production of scientific knowledge (Jacob, 1997; Ziman, 1994). Faculty or student generated technologies can lead to creation of new firms from the stuff or students with the support of venture capital (see, the Silicon Valley example), and the use of the university infrastructures (Etzkowitz and Leydesdorff, 1998). But in order to capitalise knowledge Etzkowitz and Leydesdorff (1998) stress the importance of a spiral model of innovation in order to capture the evolution of multiple linkages. The three institutional spheres (public, private, and academic) are increasingly linked with a spiral pattern of linkages emerging at various stages of the innovation and industrial policy-making process (Etzkowitz, Webster, Gebhardt and Terra, 2000).

The triple helix model (Fig. 3) is an attempt to account for a new configuration of institutional forces emerging within innovation systems (Etzkowitz and Leydesdorff, 2000).

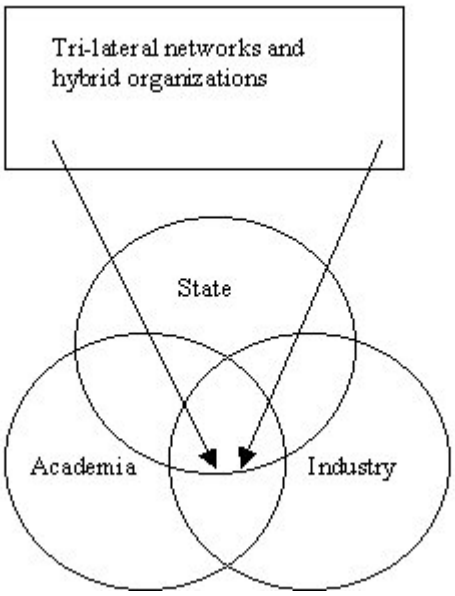

Figure 5: The triple helix model of university-industry-government relations

Thus, they distinguish among four dimensions in the development of the triple helix model related to major changes in the production, exchange and use of knowledge (Etzkowitz, et al. 2000). First there is an internal transformation in each of the helices, where companies are developing ties through strategic alliances and universities are becoming more entrepreneurial. Second there is an influence of one helix upon another. Third, there is a new overlay of trilateral linkages, networks, and organizations, among the three helixes has been created to institutionalize interface and stimulate organizational creativity and regional cohesiveness, with most prominent examples the Joint Venture Silicon Valley interaction among members. Fourth, the inter-institutional networks have a recursive effect on the spirals from which they emerged and on the larger society (the mission of economic development) (Etzkowitz, Webster, Gebhardt and Terra, 2000).

Among the effects, the degree to which academic-industrial collaboration changes the role of the university as a source of disinterested expertise must be examined. Universities have become a key element in innovation policies throughout the world, both as a source of technology for start-up firms and older companies, with the support of the government. As this, trilateral relationships at the regional, national and multi-national levels have emerged establishing spheres of interaction between the economic, political and academic institutions (Etzkowitz and Leydesdorff, 1998). Not all the countries though behave that way as they still follow old models.

> *"The complex network transforms the systems on which it rests and dynamically, the transformations have profound effects on the infrastructure of advanced societies, and consequently, on our reflexive understanding of these economies" (Etzkowitz and Leydesdorff, 1998).*

It is argued that there is an Endless Transition, where science innovate all the domains of social and economic life and the innovative environments feedback on the innovating agencies (Etzkowitz and Leydesdorff, 1998). However is not observed the same speed of transition everywhere and before we proceed has to be presented one reason of this delay, the institutions.

2.2.1 Institutional change and Evolutionary Economics

According to North (1991) institutions are the rules of the game in the society and according to Nelson and Winter (1982) is how the game is played. Institutions can cause radical change in the society and at the same time is meant that is everything structured over a period of time and so difficult to change in some countries. The institutions as defined by North (1990), who provided a framework to enable an understanding to the economical change, are humanly devised constraint that structures human, political, economical and social interaction by establishing the rules of the game. Various factors like religious, cultural, economical, geographical and historical allow to some areas to develop economically efficient institutions but not to others, like in Greece, Spain and Portugal. It is known that institutions are analogous to culture and change needs generations to pass in order to be established (Parto, 2005). After establishment, institutions can become embedded in society and are taken for granted (Van de Ven and Hargrave, 2004), maybe that could give an explanation for the delay observed in the south to reflect in changes. But institutions are part of the dynamics of technological change, they evolve parallely and interactively. So it is required analysis in order to understand and interfere in the process of technological change (Van de Ven and Hargrave, 2004) and explain the different pace of institutional change.

Institutions are resistance to change but evolve, challenge, borrow from, and displace other institutions in their continuing effort for change. That happens under stability and over long period of time; it requires exogenous attractors and internal receptors to cumulative new rules, forms, values, practices and norms, but the established institutions resist. Equilibrium has to be destroyed in the market as it shows an economy that is always evolving, and proceeds towards waves of creative destruction (Schumpeter, 1954) this would be the refreshing wind for a developing economy in a competitive world. Through this example it can be seen the various factor that prevent, not only rural areas, but urban areas too from making developmental steps towards innovation technologies. Lack of strategy, resistance to change, attempt to protect established firms and companies, corruption are some problems that need to be solved. Towards that direction the current mental models need to change, as North (1991) proposes, together with the formal and informal institutions; formal institutions like the EU, universities or money and informal like

metal models, culture or tradition (mental models are based on images, related mental models, controlled vocabulary and assumptions).

CHAPTER 4 – CENTRAL ACTORS

Now is time to identify the wide range of actors involved in the delivery of policies, their power, their position, their targets and their orientation. In the current analysis, *EU* and *member states* are the eligible main actors for funding and promoting development, innovation and technological change**.** They are the main players who have to mobilize other actors like, *citizens*, *companies* and *business* for further development. *Research institutions researchers*, *experts*, and *academics* are major actor in the whole process too. However, independent actors apart of the government do exist as well, including *non-governmental organizations* (NGOs), *universities*, *foundations*, *agencies* and *groups of citizens*. During the next pages the major actors will be presented analytically, starting from an international organization, the Organization for Economic Co-operation and Development (OECD), which reflects the current international and European tendencies towards the development of economy, and above all it is the major tool for international cooperation and coordination of policies in the western world. In short actors are classified in three categories. First, *the EU* which is delegated of the technological programmes mainly related with informational and communicational technologies (ICT) and through the Framework Programmes focus in a set of fields around NBIC (Nanotechnology, Biology, Information Technology and Cognitive Sciences). Second, *regional authorities* who support innovation in SMEs and dissemination of innovation in regional level and third the *universities*, who are expected to play the most important role in shaping the European knowledge-based economy.

Therefore, though this sociological translation, as it is known in ANT, we will process to analyze how it is constructed the new reality and the planned new society in the EU. The approach is particularly helpful because gives an explanation of the society in the making (the EU) where science and technology play a key role. It will help us to see how the scientific facts and technical artifacts are planned, established and planed for diffusion. "*Providing a social explanation means that someone is able to replace some object pertaining to nature by another pertaining to society*" (Latour,

2000). By the above Latour pretends to say that scientific and technological policies and facts are shaped by interests and ideologies, they are designed to alter the social relations, and the power in society. Lets now see analytically has this it has been planned.

3.1 OECD

The Organization for Economic Co-operation and Development[3] was founded in 1960 by 20 countries, including Greece, Spain and Portugal. Nowadays it has 30 member countries sharing a commitment to democratic government and market economy. The aim of the organization is to support, through its publications and its statistics the *member countries to improve the level of co-operation and achieve the aim of development.* The most important tool towards that target is the set of measurable *indicators* in which all the member countries are compared. Measuring indicators in economic and social issues, like macroeconomics, trade, education, development, science and innovation, OECD fosters good governance in the public services and in corporate activity. It identifies and promotes the policies that they do actually work. Thought that way policy makers adopt strategic orientations necessary for countries in a globalised economy.

3.1.1 Agenda OECD

The principal tendencies of OECD are reflected in its *objectives*; a) innovation is a complex process and indeed, it is not linear; b) companies are a key element in the process of innovation; c) human resources (HR) have a fundamental character in the process; d) technological autarchy is impossible, cooperation is the solution; and e) techno-globalisation.

a) There are consequences of the interactive model of innovation as it is difficult the distribution between basic investigation, applied and development. The process has an accumulative character and system has to be contemplated as a whole. The current era implies interdisciplinarity of the investigation and integration of the technologies. b) The company has a key role in that process. It is important to increase the investment in intangibles, where the multi-divisional system has to be replaced by an interactive system (Fordism vs. Toyotism) and competitiveness has to be increased in order to promote the use of new technologies. c) HR determines the success of the

[3] http://www.oecd.org/

process, in an era where there is an increased necessity for new knowledge, new attitudes and permanent formation. The current tendency requires increase of the demand and participation of the companies in the formation. d) Increased scientific and technological cooperation in the form networks between companies, universities and between the both is a demand of the current era. The trend is cooperation versus competition and concentration of activities. e) Techno-globalisation is the term that describes the existing stage of internationalization. The international market structure favours new technologies and national laws are ineffective and inoperative.

During the Meeting of the OECD Committee for Scientific and Technological Policy at Ministerial Level (2004)[4] titled "Science, Technology and Innovation for the 21st Century" the central sector of interest was the services sector (among others: energy, biotechnology, biotechnology, nanotechnology, neuro-informatics) and in particular, the intensive services in *knowledge* and the *software* sector. Overall the main three priorities in the government's agenda for science and technology policy are the following: a) promote better and stronger relations between the scientific system and innovation, b) ensure sustainable development in HR of science and technology and c) improve the international cooperation in science and technology in those topics that show global development.

With the above set of priorities, OECD sketches the characteristics of the new reality. A reality where the generation of innovations is a very complex process and has to be based into the interconnection between the different phases, to stress the importance in the investment and measurement of intangibles, use of HR as the key factor for formation and change the management of the companies. As a final point, it is recommended that tertiary educational institutions need to have the necessary autonomy and incentives to adapt their curriculum to the changing demand, though inter-disciplinarity and general formation. Furthermore, they are encouraged to develop agreements with companies in the alignment of the above objectives, towards a knowledge based economy. In a globalised world where everything tends to colligate into the form of networks, cooperation has become more important than competition. The above recommendations are expected to promote the growth of HR in science and technology and prevent the problems mentioned to evoke. In

[4] http://www.oecd.org/document/15/0,3343,en_2649_201185_25998799_1_1_1_1,00.html

continuation, will be presented the "tools" used by OECD to measure and guide economical development.

3.1.2 Science and Technology Indicators

OECD was created in order to apply the Marshal plan in Europe by promoting cooperation. To do that effectively measurements of the development had to be taken into account. So, the necessity of having a common terminology is essential for measurement and development. The indicators are particularly useful because can be transformed to information and provide comparative results. However, they are some problems related with its measurement too. It is difficult to measure the economic and social consequences of the technical change, as innovation is not lineal. There are always more input than output indicators and more production than diffusion indicators and as well there is a problem of international comparability in some manuals published by the organization.

OECD has published a number of manuals specifying indicators of science and technology that need to be measured. The Frascati Manual (2002) is concerned with R+D and it measures the financial and human resources used for investigation. It provides institutional classification between company, governmental, non-profit organisation and tertiary education sector. It is popularly used but it is considered relatively old. The Patents Manual (1994) is very popularly used manual which proportions information towards the distinct regimes of patents in the world, it analyses the costs of patenting, and indicates the economical impact of patents. It makes distinction between different patents: national, local and no local. The Oslo Manual (2006), an updated version, is concerned with the indicators of innovation and defines the character of novelty. Is based on the interactive model of innovation (Kline and Roseburg, 1986) and makes distinction between product innovation, process innovation, organizational innovation (intellectual capital) and marketing innovation (e.g. IKEA). Additionally it differentiates between radical and incremental innovation. The Manual of Oslo (2006) started taking effect in 2007, only in the countries of OECD. Innovations occur in different level, could be new for the business, the sector or the whole world but the most crucial part of innovation is whether or not it is introduced in the market. Schumpeter (1954) defines innovation as the change in the production process which it needs to be introduced in the market. Technological change is different from innovation, as one takes part only in the

company and the other in lots of companies, respectively. All the above were published in order to lead the members of the organization towards better management of their resources and economies and progress in the direction of knowledge based economies.

The notion of inscription (Latour and Woolgar, 1986) offers the opportunity to solve the problem of adequacy between words and things, between what someone says about things and what they really are (Callon, 1999). Inscriptions are illustrations graphics etc, and all are produced by instruments (Callon, 1999). Through the translation researchers can make statements about entities. In that case, EC or OECD can make statements about the progress and the development in member countries using comparative reports based on the indicators set by them. The researcher (or the European commission officer) in the headquarters receives tables, diagrams, based on inscriptions provided by instruments (EuroStat, national statistic agencies etc). "By circulating, inscriptions articulate a network qualified as sociotechnical because of its hybrid nature" (Latour, 1987). Here the sociotechnical network is the EU on which the statements '*real convergence'*, '*innovation diffusion'*, '*development'*, '*knowledge-based economy*' belong and involves all the relevant governments, companies, universities, NGOs etc, to work directly on the achievement of the above targets. By providing statements like "*the most competitive knowledge based economy in the world till 2010"* or "*3% of GDP in R&D*" (based on the Lisbon Strategy and the Barcelona objective) EU binds together human and non-human elements towards those targets, which commits everybody to apply it. The translation centers on the sociotechnical network capitalize all those inscriptions and statements (Callon, 1999).

The main idea of the process here is the enrolment of actors of different kind, which according to ANT, by human actors in meant the members of the EC and the EU government, of companies, universities, citizens, NGOs, international foundations and organizations etc and non-human actors such as commission's reports, framework programs, road maps, laws and regulations, international agreements, fines for monopolies, the Lisbon Strategy, Bologna Process, ERA-NETs, EUREKA, etc to archive the target set; collaboration and coordination in all levels though the process. We can see here that the Network State (and all the targets set to be accompanying this term) is at the center of the web of relations linking heterogeneous entities since it consists of humans and non-humans (Callon, Law and Rip, 1986).

If we can here use the term Network State as technical artifact in creation we can identify all human and non-humans elements within the EU. All of the elements comprising this network participate in a collective action within the whole EU. A government cannot have different destination that the rest of the EU, as the collective agreements determine what a state, a company or an organization, can or cannot do. When all EU members sets a common target (Lisbon Strategy or knowledge based society) initiates a attempt for a perfectly coordinated collective action in which all the elements of the network have to take part actively and shapely. The metaphor here is the engine, in order to work well in needs the participation of all its elements, even the tinniest ones or the bigger ones. Let's see how this engine is designed.

3.2 EUROPEAN UNION: Policy and Strategies

Following the introduction of OECD and its objectives, which were not placed by chance before the agenda of the EU, can be introduced the main targets and action of the major actor in the European peninsula, which are completely in line with the priorities set by OECD and concern governance in the EU of 27 members.

The European Science and Research Commissioner Janez Potocnik, gives the catchword "*we need to be pioneers again, with knowledge, solidarity and change of attitudes" he says and continues freedom of labour, services and trade, now is the time for the freedom of knowledge. The requirement for that change is to move towards a new mind set with private sector, public funding and universities in the first line*" (the Triple Helix model in other words). He calls everybody to put research into the centre of society and let people think of research in order to shape economic change. Let's see now what has been done and has been planed towards that direction from the EU and what is made from the rest of the actors.

3.2.1 Lisbon Strategy and Barcelona Objectives

The recent history of European R&D and innovation policies starts from 1995 and the publication of the Green Paper on Innovation, in 1996 the First Action Plan for Innovation in Europe was a detailed set of objectives for co-ordinated action of all actors, to foster an innovation culture, create an environment conducive to innovation and orient research to innovation. In 1998 the EC's Communication 'Innovation for Growth and Employment' was a report on implementation of the Innovation Action Plan and review of priorities concerning protection of intellectual property, financing

innovation, the regulatory framework and administrative simplification, education and training, gearing research towards innovation and strengthening overall co-ordination. The European Council in Lisbon in 2000 set an ambitious goal for EU "*to become the most competitive and dynamic knowledge-based economy in the world by the end of the decade*". The Council emphasised innovation's importance as the main source of competitiveness and economic growth, and its key role in the creation of the European Research Area. Following, the EC published its Communication 'Innovation in a Knowledge-driven Economy' (2000) responding to the goals set by the Lisbon Council. The Commission defined a timetable for concrete progress towards five innovation-related objectives: coherence of innovation policies, a regulatory framework conducive to innovation, encourage creation and growth of innovative enterprises, improve key interfaces in the innovation system and a society open to innovation. In the communication it was included the first pilot edition of the European Innovation Scoreboard which followed later on in 2001. In 2002 the European Council in Barcelona called for "*a significant boost of the overall R&D and innovation effort in the Union, with a particular emphasis on frontier technologies*", setting 3% of GDP as a target for EU expenditure on R&D and innovation by 2010, and emphasising that 2/3 of this should come from the private sector.

Knowledge-Based Economy and Knowledge Management

The concept of knowledge-based economy, introduced by evolutionary economists (Foray and Lundvall, 1996; Abramowitz and David, 1996; OECD, 1996), has been a key factor and priority of development. Knowledge is a production factor and the actual economy is intensive in knowledge. There are two complementary views on that concept. First, the competition of individuals is the base of economic development and second, the economic development depends upon the increasing form of the production, the distribution, and the use of knowledge. The main concern of the organization is how to measure knowledge, as what is not measurable it is not manageable and so on new instruments of measurement are essential. It is known that knowledge is not information and there is difficulty in the distinction as knowledge is partially codable. The cost to reproduce information is naught but cost of reproducing knowledge is high as it is difficult to transmit the cognitive capacities and requires interaction between educator and learner. The produced knowledge is associated with R+D. The sector is dedicated to production but knowledge is a sub product of the

production too. Empirical evidences demonstrate the expansion of knowledge industry in education sector, informatics sector, communication media, and information services.

The major difficulties in knowledge measurement are related with heterogeneous elements Foray (2004) says. The major part of knowledge is not observable, it is *tacit* and there is no specific mechanism to guarantee the transformation of input to output as there is no function of the production of knowledge and there is no form to measure stocks. Still, there is no knowledge market and the system of indicators can not serve as an indicator. Knowledge is the consequence of patentable or no-patentable inventions or discoveries. It is partially localised and its generation can be costly, but it can not be held exclusively as it spills over. It is not persistent, it can be forgotten if its transmission is interrupted. It is scattered to persons and places; it is sticky, it adheres in the place where it is generated and it is costly to transfer. Till 1995 the primary objective was the creation of knowledge. Special attention was paid in R+D and the elements and the interrelations that produce science. However, creation of knowledge is not enough. David Foray (2004) paid special attention in the diffusion of knowledge, the national system of knowledge distribution and he specified objectives of the knowledge economy. That is, to analyse and challenge the institutions, the technologies and the social rules that can facilitate efficient production and the use of knowledge. Having in mind that the mechanisms of assignation of recourses that operate in the world of the good tangibles there are not adequate to maximize the creation and the diffusion of knowledge.

The EU has encountered five major weaknesses in basic research where towards five programmes is expecting to provide the solutions. First, the Marie-Curie Scheme[5] is expected to fight the training and mobility problem. Second, the new Research Infrastructure policy[6] is expected to battle the problem of research infrastructures in Europe with the assisting role of ESFRI (The European Strategy Forum on Research Infrastructures). Thirdly, towards the capacity building under Structural Funds[7] EU increase cohesion in the Union. Forth, the problem of

[5] http://ec.europa.eu/research/fp6/mariecurie-actions/action/knowledge_en.html
[6] http://cordis.europa.eu/infrastructures/
[7] http://ec.europa.eu/regional_policy/funds/prord/sf_en.htm

excellence in Europe is expected to be confronted towards the ERC[8] (European Research Council). And lastly, the fragmentation observed throughout Europe will be encountered through the coordination of the programmes. European Commission sees science and technology as the key to Europe's future and sets six key axes of the FP7[9] towards that direction: Collaborative research, Human Resources, Research Infrastructures, Coordination of National Plans, Technology Initiatives (new) and Basic Research Competitive Funding (new). Through those actions would be taken advantage of the intellectual capital in Europe.

Intellectual Capital: Measurement and Management

Intellectual capital is considered to be knowledge that can be used for profit making, invested to produce more goods and services from a company or an organization. That can include individual employees, or knowledge developed form the company, including processes and other information that is not common knowledge. In economics those information are called "intangibles" and are vital for the economical development (Cañibano and Sánchez, 2004). Generally, integral intellectual capital (active intangibles) in a company has to do with *human, organizational and relational capita* but in governmental level with *social capital*.

The so called traditional *intangibles* are commercial funds, marks, licences, author rights, patents, cooperation agreements, franchising, software, advertisement, formation, reorganization costs or R+D. For the measurement of those intangibles exist financial indicator, but when internally are recognized as expenditure not always can be identified financially. The new intangibles are intangibles of which the company has no control upon, and still there is no any existing market, as R+D in process, negotiation secrets, reputation, direction systems and market processes (Cañibano and Sánchez, 2004). The *human capital* in a company is all the variables related with the human resources. For example, what is the percentage of qualified workers with a university title, how satisfied are the workers from the company, how much money are spend for formation and training (competitiveness improvement), how many workers rotate (changeability), the cost and benefits (financial indicators), and the utilization of all of them, how it is managed and diffused. Following, the *organizational capital* in a company has to do with technology, organizational

[8] http://erc.europa.eu/
[9] http://cordis.europa.eu/fp7/home_en.html

structure and processes, in few words is what remains in the company when the worker leaves the job. For example, what is the percentage of p/c per employee and how much the company invests for new technologies, how many employees work from distance and what are the structural changes taking part, and if a diminishment in the hierarchical level takes part. The *relational capital* has to do with clients, networks and agreements. This includes detailed information about the number and the characteristics of the clients, the type networks set and the type of agreements and collaborations signed. Moreover the customer's satisfaction is another variable which has to be taken into consideration. Other activities related with the relational capital has to do with the measurement of the customer's fidelity and the percentage of antiquity among them, and the company's image related to company's preference for new graduates. The problem with the *intellectual capital* is that exist various models but does not exist a theory which could allow making predictions. Various projects by the EU though have been launched to solve that problem.

At first, the project MERITUM (Measuring Intangibles to Understand and Improve Innovation Management) formed in order to undestand and imporve the innovation management by Spain, France, Noorway, Sweden, Finland and Denmark (1998-2001). The objective was to elaborate on a group of directives that will measure and diffuse the information about intangibles for internal and external use. Promoted first, instrumental concepts and practices to companies in order to measure and manage their intangibles. Second, narrative reports about intangibles, and thirdly, stressed the importance of the company's vision (setting strategic objectives, essential competencies and critical intangibles). Forth, measuring resource and activities intangibles, and fifth establishing a system of indicators. Another project was the E*KNOW-NET (2001-2003) which created a European arena on intangibles in the participating countries, Spain, France, Norway, Sweden, Denmark, Italy and the Netherlands. The objectives of that project was to create a global virtual network, applying in practice the MERITUM model and develop an agenda of European investigation and formation programmes.

The above projects, supported by the EU, have been in line with the current EU's basic preoccupations. First, the Union wants the activation of *knowledge*, based on the Lisbon strategy (2000) and Barcelona agreement (2002). Secondly, calls for more attention in the Small and Medium Enterprises (SMEs) by promoting the RICARDIS (2006) programme which is about reporting the intellectual capital to

augment research, development and innovation in SMEs. In the next paragraphs the program and the objectives of European Union will be explained further. Although, the priorities have been already set by OECD and consequently EU has to move towards the direction of the globalised economy faster.

3.2.2 The Statistical Office of the European Union and Innovation Scores

The EU uses its own statistical agency to measure and control changes in the Union. "Eurostat's mission is to provide the European Union with a high-quality statistical information service", is stated in the official site of the organization. Towards that direction Eurostat works together with the national statistical authorities in order to ensure that data collected about indicators are counted and measured in the same way in all member states and so on provide comparable data. In other words, provides a common statistical language in the EU using a harmonised methodology, because "apples have to be compared with apples", as it is mentioned characteristically. In order to evaluate and assess the long term progress in the Union, Eurostat provides 'structural indicators' about general economic background, employment, innovation and research, economic reform, social cohesion, and the environment (Appendixes).

The European statistical agency (Eurostat) provides a wide range of data on innovation, human resources in science and technology, patent applications to the European Patent Office, patents granted by the United States Patent and Trademark Office, R & D expenditure, R & D on government budget appropriations or outlays for research and development, scientific and technical R & D personnel, employment in high-technology sectors and more. Following the decision of the Lisbon Summit in 2000 to make the EU the most competitive and dynamic knowledge-based economy in the world Eurostat contributes on that by providing reliable and relevant statistical information for deeper analytical studies.

Towards that direction the European Innovation Scoreboard prepared by Maastricht University for the European Commission is based on input and output for innovation. The measures of Eurostat, OCED and the Office of Harmonization for the Internal Market (OHIM) are taken into consideration to compose this report. In its last report about development of national innovation performance they were observed significant national differences. In the Summary Innovation Index (SII) below the countries above the horizontal axis have an innovation performance above that of the

EU25 and countries to the right of the vertical axis line had a faster average increase in the SII than the EU25. This performance distinguishes between four groups according to the European Innovation Scoreboard.

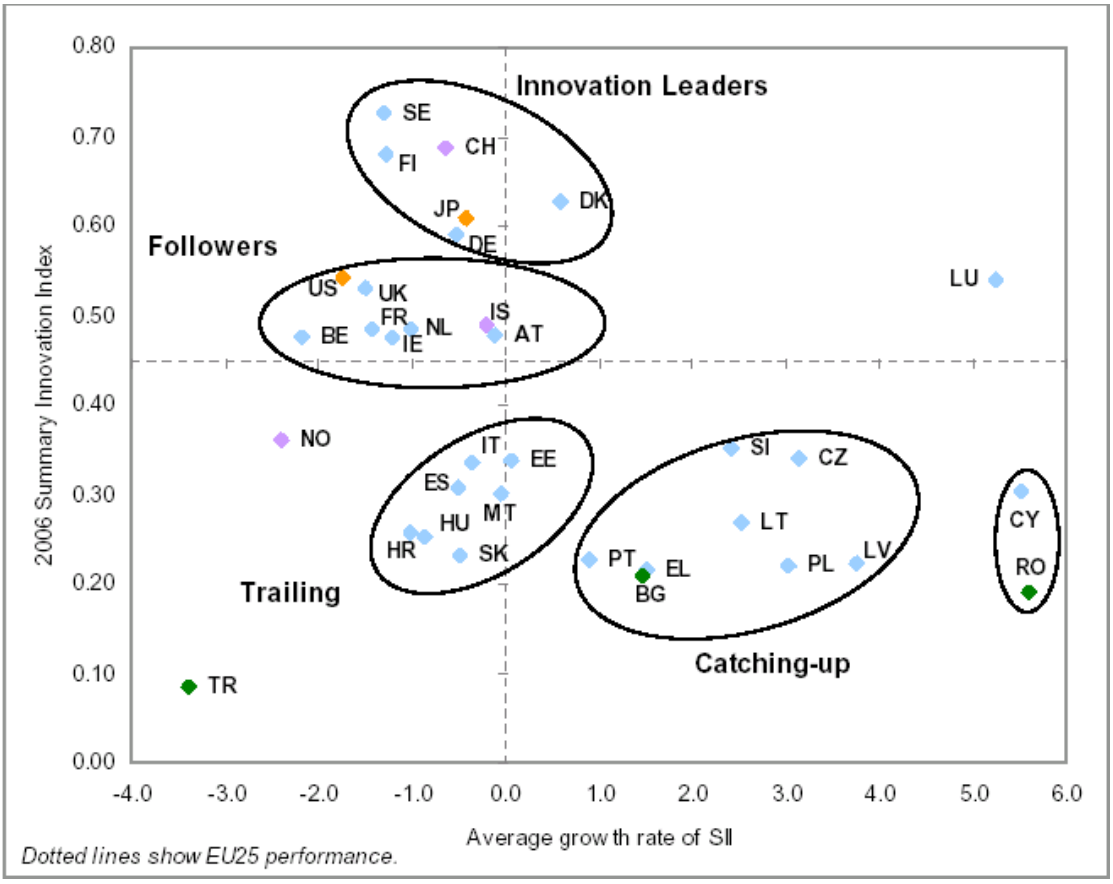

Figure 6: The summary innovation index (SII) and trends

a) Sweden, Switzerland, Finland, Denmark, Japan and Germany are the *innovation leaders*, with SII scores well above that of the EU25 and the other countries. The lead of the innovation leaders has been declining compared to the average of the EU25, with the exception of Denmark.

b) The US, UK, Iceland, France, Netherlands, Belgium, Austria and Ireland are the *innovation followers*, with SII scores below those of the innovation leaders but above that of the EU25 and the other countries. The above EU25 average innovation performance of the innovation followers has been declining. Also, the gap of the innovation followers with the innovation leaders has on average slightly increased.

c) Slovenia, Czech Republic, Lithuania, Portugal, Poland, Latvia, Greece and Bulgaria make up the group of *catching-up countries*, with SII scores well below that of the EU25 and the innovation leaders, but with faster than average innovation performance improvement.

d) Estonia, Spain, Italy, Malta, Hungary, Croatia and Slovakia seem to be *trailing*, with SII scores well below that of the EU25 and the innovation leaders, and innovation performance growth which is either below or only just above that of the EU25.

In the figure below can be seen the actual score of each country in the list with Greece and Portugal right at the end of the list ahead of Bulgaria, Rumania and Turkey. Spain has better scores but as it has been mentioned above it is trailing and its innovation performance scores are below of the EU25.

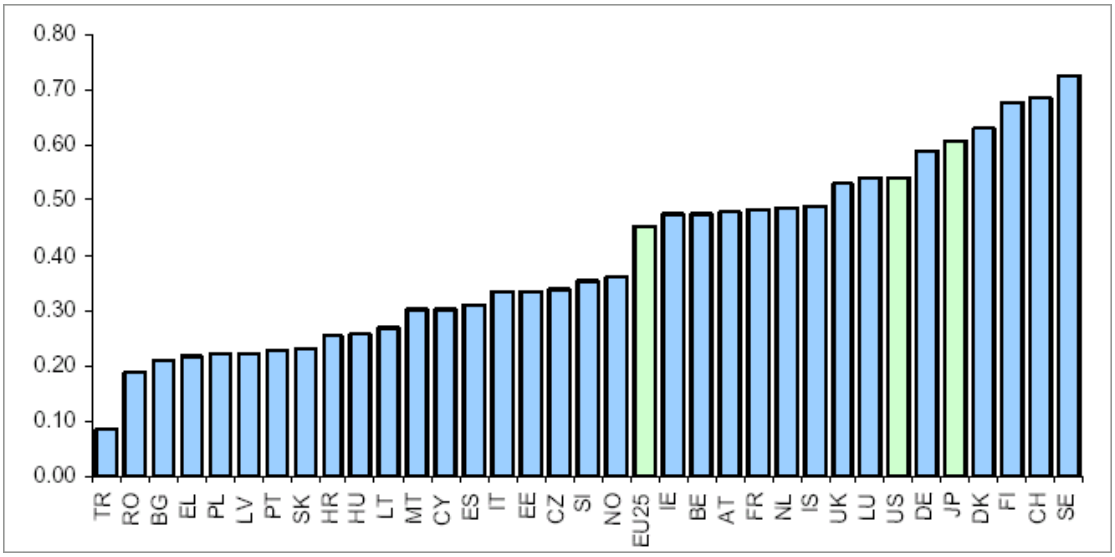

Figure 7: The 2006 summary innovation index (SII)

In the next figure of the European Innovation Scoreboard can be seen the scores of the countries in each of the five measured dimensions of innovation. Most of the countries perform at a comparable level but there are some noteworthy exceptions. The innovation leaders like Germany and Austria are performing relatively worse in Innovation drivers and even worst Spain, Greece and Portugal. The Netherlands in innovation and entrepreneurship has almost the same score with Greece which shows better results in that dimension, meanwhile Spain posses the last position in the list. Among the best performers in that dimension is Estonia, the new member state

occupies the forth position in innovation and entrepreneurship. The leaders, the Netherlands, Austria and Iceland in applications dimension score the same with Spain meanwhile Greece and Portugal are found at the last positions among the new member states. Surprising Malta has the best score in applications followed by Germany, far ahead than all the rest.

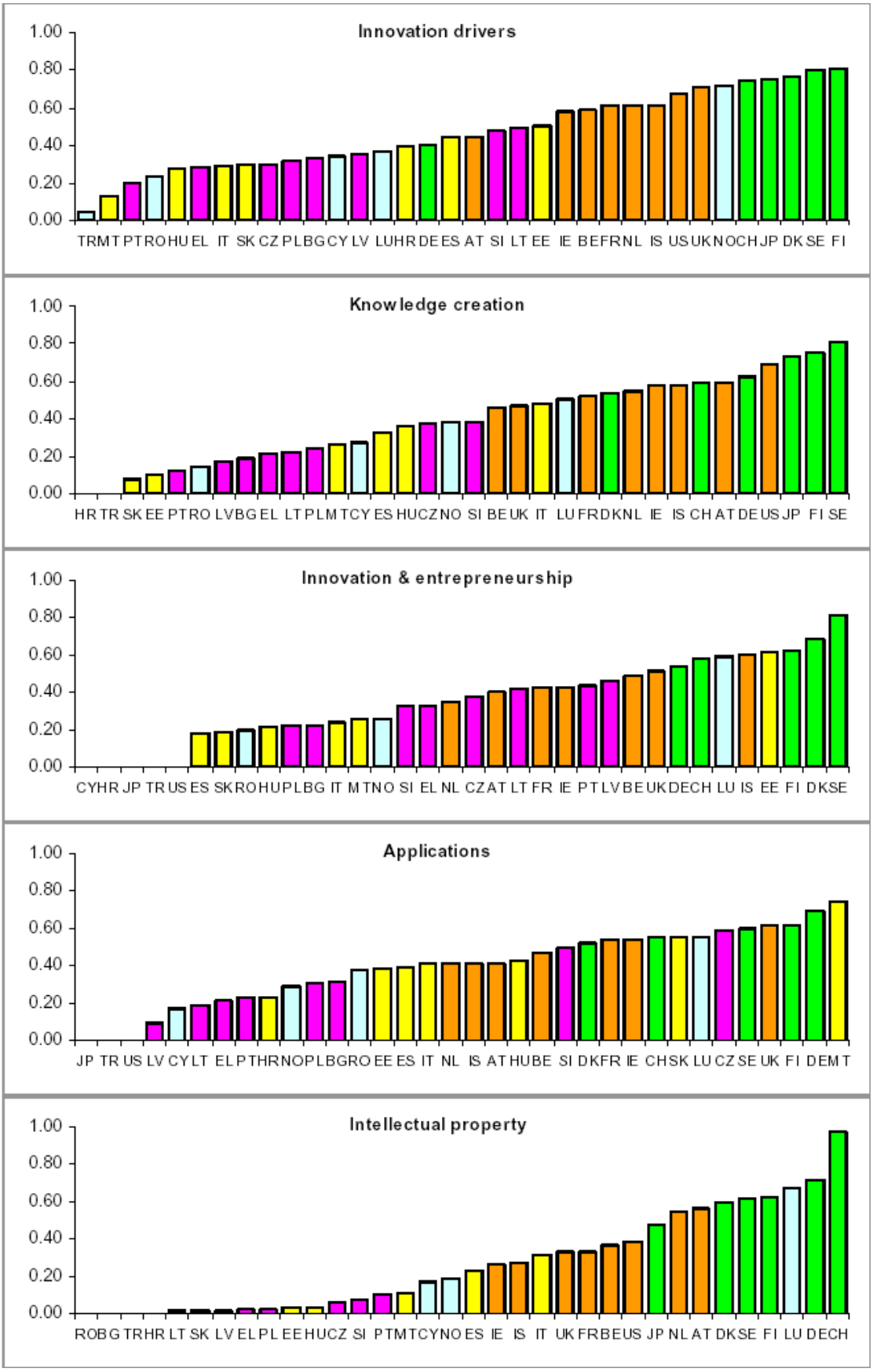

Figure 8: Innovation performance per group of indicators

	EU25	EU15	European 'innovation leaders'			US	JP
INNOVATION DRIVERS							
1.1 S&E graduates	12.7	13.6	IE (23.1)	FR (22.0)	UK (18.1)	10.2	13.4
1.2 Tertiary education	22.8	24.0	FI (34.6)	DK (33.5)	EE (33.3)	38.4	37.4
1.3 Broadband penetration rate	10.6	12.0	IS (22.5)	NL (22.4)	DK (22.0)	14.9	16.3
1.4 Life-long learning	11.0	12.1	SE (34.7)	UK (29.1)	DK (27.6)	--	--
1.5 Youth education	76.9	74.1	NO (96.3)	SK (91.5)	SI (90.6)	--	--
KNOWLEDGE CREATION							
2.1 Public R&D expenditures	0.65	0.66	IS (1.17)	FI (0.99)	SE (0.92)	0.68	0.74
2.2 Business R&D expenditures	1.20	1.24	SE (2.92)	FI (2.46)	CH (2.16)	1.87	2.39
2.3 Share of medium-high/high-tech R&D	--	89.2	SE (92.7)	DE (92.3)	CH (92.0)	89.9	86.7
2.4 Share of firms receiving public funding	--	--	LU (39.3)	IE (27.8)	AT (17.8)	--	--
INNOVATION & ENTREPRENEURSHIP							
3.1 SMEs innovating in-house	--	--	IE (47.2)	IS (46.5)	DE (46.2)	--	15.3
3.2 Innovative SMEs co-operating with others	--	--	DK (20.8)	SE (20.0)	FI (17.3)	--	6.9
3.3 Innovation expenditures	--	--	SE (3.47)	EL (3.08)	DE (2.93)	--	--
3.4 Early-stage venture capital	--	0.023	DK (0.068)	SE (0.067)	UK (0.048)	0.072	--
3.5 ICT expenditures	6.4	6.4	EE (9.8)	LV (9.6)	SE (8.6)	6.7	7.6
3.6 SMEs using organisational innovation	--	--	CH (63.0)	LU (58.4)	DK (57.1)	--	--
APPLICATIONS							
4.1 Employment in high-tech services	3.35	3.49	SE (5.13)	IS (4.97))	DK (4.69)	--	--
4.2 High-tech exports	18.4	17.7	MT (55.9)	LU (29.5)	IE (29.1)	26.8	22.4
4.3 Sales share of new-to-market products	--	--	MT (13.6)	SK (12.8)	PT (10.8)	--	--
4.4 Sales share of new-to-firm products	--	--	PT (15.1)	DE (10.0)	ES (10.0)	--	--
4.5 Employment in medium-high/high-tech manufacturing	6.66	6.71	DE (10.43)	SI (9.63)	CZ (9.42)	3.84	7.30
INTELLECTUAL PROPERTY							
5.1 EPO patents	136.7	161.4	CH (425.6)	DE (311.7)	FI (305.6)	142.6	174.2
5.2 USPTO patents	50.9	60.2	CH (168.4)	DE (123.0)	SE (109.7)	277.1	304.6
5.3 Triad patents	32.7	38.9	CH (108.9)	FI (101.7)	DE (85.2)	47.9	102.1
5.4 Community trademarks	100.7	115.7	LU (782.7)	CH (225.2)	AT (187.0)	33.8	11.7
5.5 Community designs	110.9	127.6	LU (377.6)	DK (243.2)	CH (210.0)	17.5	13.2

Table 1: Innovation performance leaders

From the above results is getting obvious that competition in EU27 has been increased. The initial fears that new member states will overpass in performance the southern member states and will approach more the developed states have been demonstrated in the graphs above. Following, another graph, provided by the European Innovation Scoreboard identifies the best three country performance in innovation indicators. The innovation leaders show an outstanding performance in the

leading slots (50%), the innovation followers 20% and the trailing countries and catching-up countries each 10% of the leading slots. The innovation leaders are particularly dominant in knowledge creation, innovation and entrepreneurship and intellectual property. The innovation followers are most dominant in innovation drivers. Spain and Portugal are particularly dominant in application and in "sales share on new-to-firm products" indicator meanwhile Greece is dominant in innovation and entrepreneurship and the "innovation expenditures" indicator, a very prospectus result for the country's future on innovation (see Appendix I for a comparative analysis in innovation performance).

An explanation about the limited scores in innovation among the southern countries is the lack of a favourable framework for innovation to occur and the limited participation in networks. Another report completed by the "The Gallup Organization" on behalf of the Eurobarometer is called the "2006 Innobarometer" and is investigating the cluster's role in facilitating innovation in Europe. They particularly analysed the proportion of firms working in cluster-like environment. The results of the research revealed dramatic differences between the European countries with only very few countries achieving high scores, and very little proportion of firms were classified as operating in a cluster.

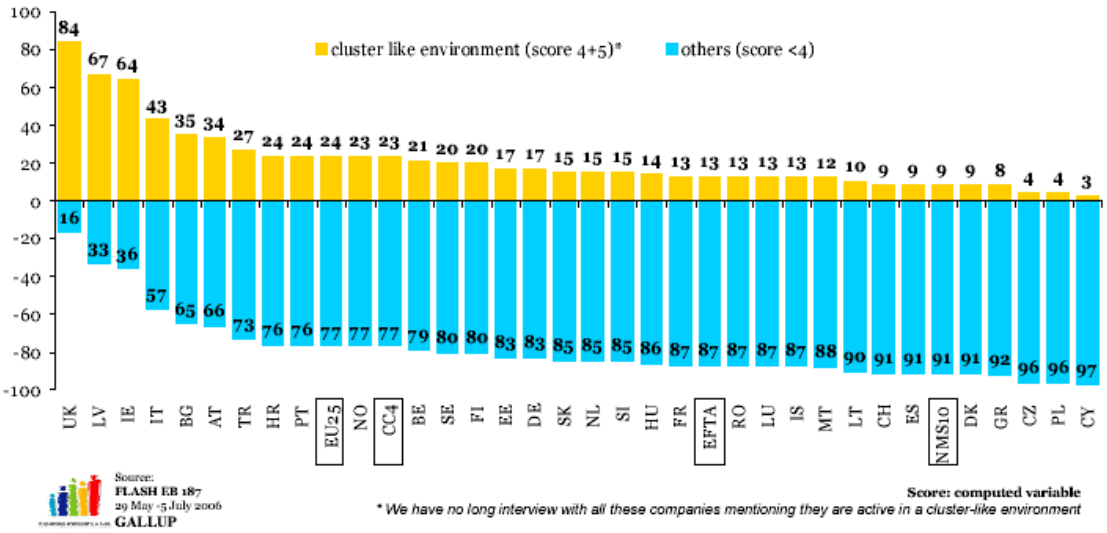

Figure 9: Companies active in cluster-like environment

From the results of the research is shown that the United Kingdom dominates the landscape of the companies that operate in cluster-like

environment (qualified as "cluster" company) with 84% and followed by the new member state Latvia (67%) and the country with the highest economical development in Europe, Ireland (64%). In the second group with relatively high proportions of cluster-like environment were detected in Italy (43%), Bulgaria (35%) and Austria (34%). At the end of the list are found Greece and Spain with very poor results as only 9% qualified as cluster companies. Portugal is performing much better in that stage with 24% of companies in a cluster like environment.

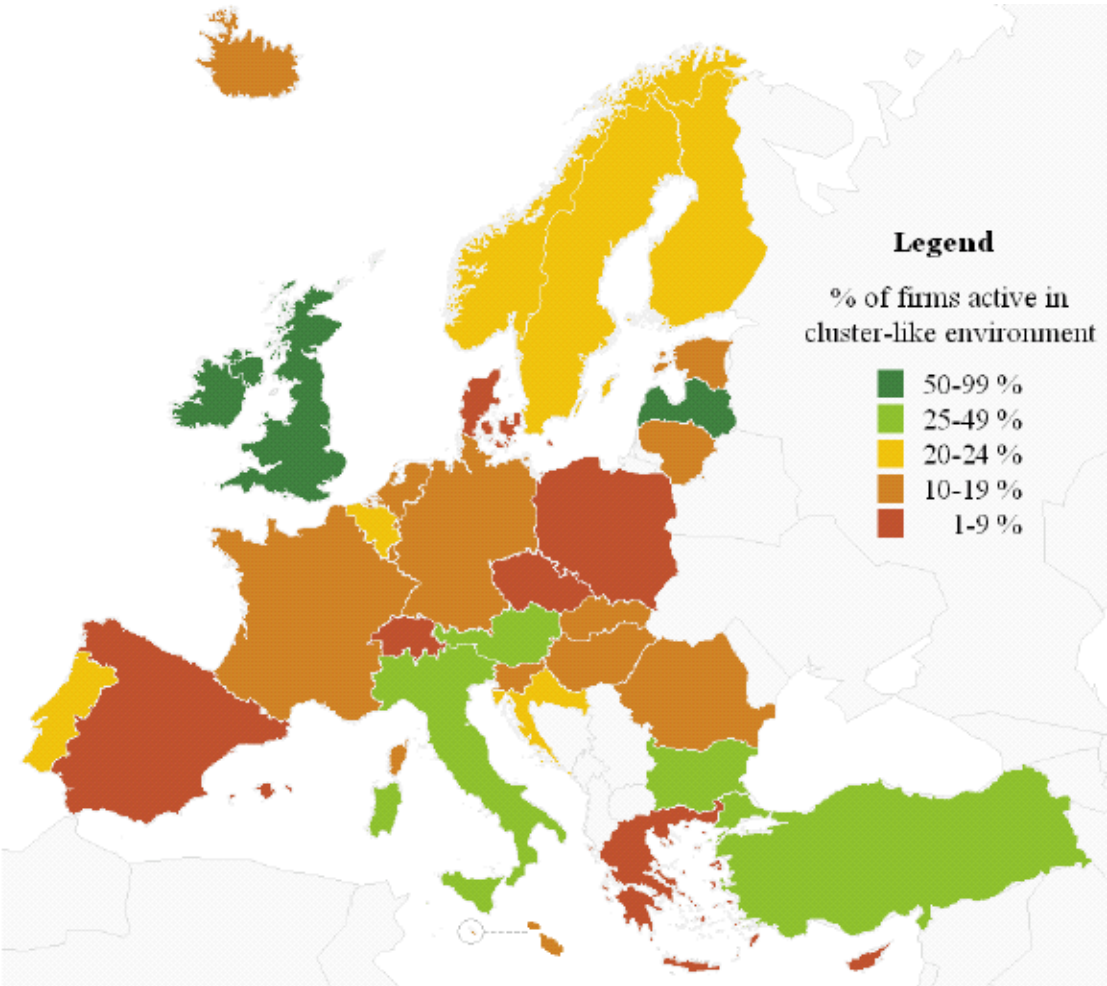

Figure 10: Percentage of firms active in cluster-like environment (Source: Flash Eurobarometer 187)

Even though EU has a long history in the support of companies and in the financing of technological and scientific project it appears that the results vary among the countries who received support.

3.2.3 7th Framework Programme (FP7) for R+D

The history of EU involvement in R&D starts from the 1957 treaty, which did not mention anything about R&D, although R&D was present in the Coal and Steel treaty (1952) and in the EURATOM treaty (1957). During 1968 the European Commission was created and the first initiatives launched in 1974 following the energy crisis in Europe. During 1979 and 1982 an intense debate on IT (information technology) was the answer to the growth challenge as appeared the failure of bilateral industrial approaches. The EC commissioner Davignon "created" the ESPRIT[10] new model compound by stakeholder consultation "the table ronde", research consortia (multiple countries, multiple types of actors) and public funding through "cost-shared" projects. The impact of the ESPRIT model was that succeeded to include R&D in the EU treaties; the Single Act (1987) and "the S&T bases of European industry", the Maastricht (1993) and S&T to support European policies, and the five year framework programme as the implementation arm. Evaluation of the programmes was a mandatory requirement to ensure success and results. The FP exposed a fast growth to stabilisation. From FP1 to FP3 (1984-1994) was shown a fast yearly increase of expenditure (from 1 to 3 billon euro /year). From FP4 to FP6 was shown a "slow" yearly growth (from 3 to 4.5 billion euros), and during the FP7 the increase should arrive to 10 billion euro in 2012.

The European Union has a number of financial support programmes to facilitate development, but none is as ambitious as the famous 7th framework programme for research and technological development. The 7th framework programme for research and technological development is the basic tool of EU to deal with the needs of employment and competition in order to maintain its leading role in the global knowledge based economy. With a budget of 53.2 billion euros for the following 7 years (2007-2013) the FP7 is till now the highest financial support in the research sector. The target of EU is to provide researchers with support, infrastructure and the necessary opportunities they need, in order to play their own role in the maintenance of a competitive and sustainable Europe. It will help to confront citizens' problems by providing innovative ideas, new perspectives and practical solutions in vital sectors for the European future like: energy, environment protection, health, food and biotechnology, nanotechnology and new materials, transports, socio-economical

[10] http://cordis.europa.eu/esprit/home.html

sciences, informatics and communication, space and security. The FP7 is divided into four programmes. The 'Cooperation' programme supporst research cooperation in a number of key thematic areas, like life sciences, information and communication technologies, food quality and safety research. The 'Ideas' programme funds investigator-driven research through a newly created European Research Council (ERC). The 'People' programme supports training and researchers' career development, while 'Capacities' programmel funds the coordination and development of research infrastructure, regional research clusters, international cooperation and closer ties between science and society.

During the long history of the FPs there were various changes and evolutions. In FP7 the *Thematic priorities* account for the 64% of the programme and the structural dimensions for the 36% of the programme. The thematic priorities are energy (from 50% in FP1 to 5%+ in FP7) and environment (moved from 8 to 4%), ICT (peaked at 42% in FP2 to 18% in FP7), health and biotech (reached in FP5 a plateau of 16%) and industrial technologies (have moved between 15 and 20% through a large reshaping). In FP7 industrial technologies have been cut in three, nanotechnologies and materials (7%), transport (8%) and 9% for space (appeared in FP5) and security (new in FP7). The *Structural dimensions* are compound by human capital mobility (reached its plateau in FP3, 9%), infrastructures (since FP5, 4%) and basic research (ERC, 15%). Others structural dimensions include the JRC (3%), SME support (2.5%) and international cooperation. Those are in accordance with the 2000-2002 Lisbon Agenda, Barcelona Target and the European Research Area in order to reach the target (to become EU the most dynamic knowledge-based society) and the objective set (3% of GDP for R&D in 2010, 2/3rds by firms and 1/3rd by public sector).

The FP is just one tool in order to overcome the fragmentation and increase excellence in the EU by the use of new instruments (Networks of excellence, Integrated Projects, Joint Technology Initiatives, European Research Council) and the coordination of policies through new approaches (Open method of coordination; ERA-NETs between national operators; joint EC-nation funding, article 169; Technology platforms, shared visions and agendas). Since the 1980s, it moves towards devolution and decentralization have been made to address issues linked with technology, science and higher education, like strong convergence on support to innovation in SME, decentralisation of universities and university funding, with

Europe as a key driver and structural funds, RITTS/RIS initiatives and Europe of regions. The future is now and Europe develops the talent, the abilities, the passion of its human resources and looks ahead.

Science and technology in the EU

The rise of EU gave space to become the main actor in Science, technology and innovation. With a broad ranging of public interventions, mostly through inter-governmental arrangements EU has managed to increase the levels of cooperation. The *European intervention* established large instruments like CERN (Conseil Européen pour la Recherche Nucléaire or European Council for Nuclear Research) ESO (European Southern Observatory or European Organisation for Astronomical Research in the Southern Hemisphere), ESRF (European Synchrotron Radiation Facility**)**, JET (Joint European Torus or Nuclear Fusion Research Facility) and ITER (International Thermonuclear Experimental Reactor or Nucreal Fussion Project). The new space policy focused on Ariane launchers, research satellites and programmes, GPS (Global Positioning System) via Galileo (the European Satellite Navigation System) and meteorology. Following, large industrial "objects" tag along, Airbus but also semi-conductors (through the EUREKA initiative), large wind mills, and the Europeanization of the defence firms. Most industrial gatherings linked to ad-hoc interventions (Airbus, defence). Framework conditions were set with norms and directives (telecoms, energy). The Framework programme was the big tool with its focus on new technologies (NBIC). However, each scientific instrument has its own structure and its specific rules and functioning. For example, ESA (European Space Agency) is a front runner in technology and its funding is linked to the GDP of nations, the European Science Foundation built by research agencies and institutions, or EUREKA which is a bottom-up based programme which separate public funding (approach and implementation of it) and EU can only contribute with benchmarking and the circulation of "good practice". Actions and initiatives like the above intent to create networks and facilitate the diffusion of innovation; EUREKA is an old example of it and thought company participation is shown how active each a country is R&D and innovation.

3.2.4 EUREKA Network

EUREKA is a pan-European network for market-oriented, industrial R&D. It is an intergovernmental initiative with aim to enhance European competitiveness through its support to businesses, research centres and universities who carry out pan-European projects to develop innovative products, processes and services. It is a flexible and decentralised network which offers expertise across Europe and facilitates access to national public and private *funding schemes* in order to build partnerships that will penetrate new markets. The programs included are: *clusters* in order to play a key role in building European competitiveness; *umbrellas*, thematic networks which focus on a specific technology area or business sector, to facilitate the generation of EUREKA projects in its own target area and gives the opportunity for enterprises from all Europe to play an active role on that by encouraging and assisting them to innovate. It is an initiative that complements the European Union's Framework Programme in working actively towards the common European objective of raising investment in R&D to 3% of GDP by 2010. It publishes the results in its annual report[11].

In this analysis is presented a comparison between Greece, Spain and Portugal, and the leading economy of EU, Germany, and the technologically advanced Sweden. As it can been seen Spain shows a high participation in the EUREKA projects and seems to have motivate the SMEs to increase their participation. Comparing the three similar countries, in population, Sweden, Greece and Portugal the differences are more than obvious. Sweden is much more active in project participation than Greece and Portugal with much more participation of SMEs that the other two. Greece exposes the less participation at all levels and this raises questions about the policies applied and the motivation of SMEs, research centres and universities to participate. Portugal shows better performance that Greece but still when is compared with Sweden the discrepancy is seen.

[11] http://www.eureka.be

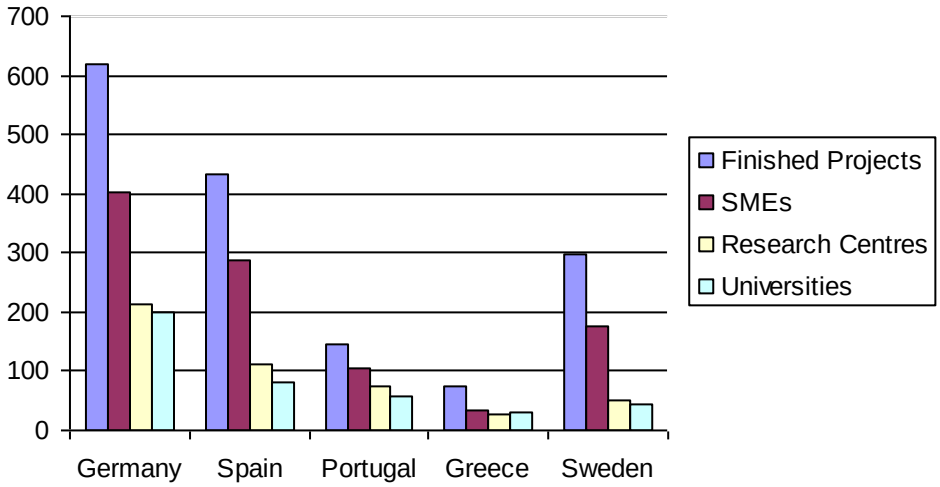

Figure 12: Participation of countries, SMEs, research centres and universities in EUREKA projects

Castell's network society results from the interaction of the social organization with the social and technological change in the ICT. The networks created here possess three features; flexibility, adaptability and ability to survive. They reshape based on the changes of the surroundings and they find new connections, are reducing or expanding with few alterations and when they do not have a centre and to be able to act within an ample range of configurations, the networks can repulse attacks to their nodes. Greece and Portugal does not seem to follow this way of adaptation and flexibility. Spain seems to have make steps towards the transformation of its economy and the results can be seen in the increases participation, as they try to cope with the expectations a big economy as Spain has. Sweden and other northern states have adapted their economies on the new reality long time ago and the results can be seen in numbers. This is a trend shown by company participation within EU, following will be analysed how active the local governments are within the structures of EU.

3.2.5 ERA-NET Scheme

The ERA-NET scheme was launched for "the cooperation and coordination of national or regional research and innovation activities through networking of programmes, including their mutual opening and the development and implementation of joint activities" by the European Commission. It was a highly innovative component of the European Union's Sixth Research Framework Programme (2002-2006) and complementary to other frameworks of research

cooperation such as COST and EUREKA. The initial idea was borne in January 2000 from the proposal for the creation of a European Research Area (ERA) from European Commission in its communication "Towards a European Research Area".The scheme enabled national systems to take on tasks collectively that they would not have been able to tackle independently. Participation was restricted only to national or regional authorities finding research activities. Eligible for participation were only public bodies responsible for financing or managing research activities carried out at national or regional level, other national or regional organisations that finance or manage such research activities and bodies operating at European level that include as part of their mission the pan-European coordination of nationally-funded research. In short, participants in the programmes are programme managers working in national ministries and funding agencies, not universities or enterprises. Overall, 25 EU Member States, 8 Candidate and Associated States and 5 Third Country States participated in the programme.

The *objective* of the programme is related to the overall targets of European Union and its effort to obtain a world leading role. In order for Europe to take full advantage of its enormous potential for scientific advancement and innovation, it needs to increase the overall resources allocated to research, mobilise resources on a wider scale by joining forces, and avoid duplication of effort by ensuring greater coherence between national programmes. The overall objective is to reach the target set in Barcelona: to invest at least 3% of EU GDP in research activities.

With the aim of fostering coordination and cooperation between programmes ERA-NET schemes should follow a '*four step process'*: Systematic exchange of information and best practices on existing programmes and activities, identification and analysis of common strategic issues that could lead to multinational schemes between ERA-NET partners, planning and development of joint activities between national and regional programmes and implementation of joint trans-national research activities including joint calls and programmes. At the final step all participants are expected to move on together with a common strategy, common calls, common evaluations and common dissemination plan. Commission did not give priority to any research field, all proposals were welcomed. Commission had the responsibility for the evaluation of the proposals by using a '*peer review system'* formed by experts in the field of each proposal. When an ERA-NET scheme was approved a coordinator was set and the partners had to establish a 'unified management framework', with

specific staff dedicated to coordinating their activities and ensuring continuity of operations, and giving a long-term nature of the cooperation inside an ERA-NET

European Commission did not provide any funding for research carried out within the programmes that make up the ERA-NET but provided funding only for the implementation and preparation of an ERA-NET. Participants should continue to fund research activities themselves. The initial indicative *budget* was 183 million euros and there were two types of funding provided. A) *Specific Support Actions* (SSAs) to facilitate the preparation of future ERA-NETs, in particular to Candidate Countries. B) *Coordination Actions* (CAs) for the support and implementation of an ERA-NET scheme that shall involve many levels of cooperation and coordination, a step by step perspective. To implement an ERA-NET were provided on average three million euros for a period of five years maximum.

Overall, 2,000 programme owners and participants applied to be included in ERA-NETs with over 1,000 eventually involved in the successful networks from 38 countries. Of the proposals selected for funding, 26 were SSAs, 11 of which eventually became full CAs, which made a total of 71 CAs for full ERA-NETs. The selected 71 CA projects spanned four broad *vertical areas* (industrial technologies, life sciences, environment and energy, and humanities and social sciences) and two crosscutting *horizontal areas* (international cooperation and fundamental research) (see Appendix II for a full list of ERA-NET schemes).

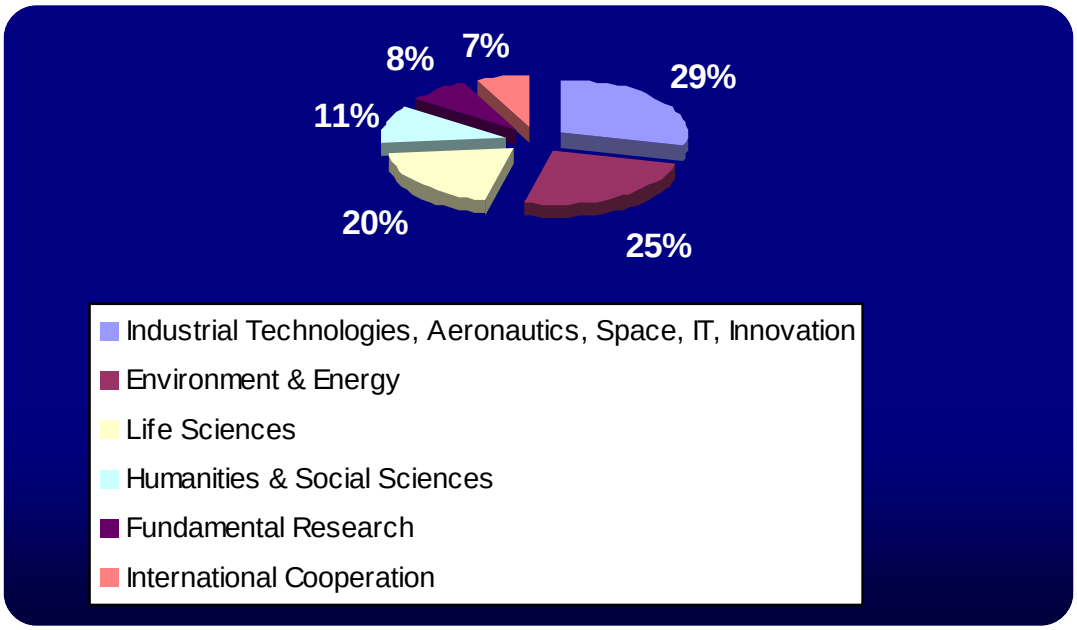

Figure 13: Distribution of ERA-NETs in various research areas

Representatives were largely drawn from ministries (38%), research councils (23%). agencies (20%), technology agencies (11%) and other organizations (8%).

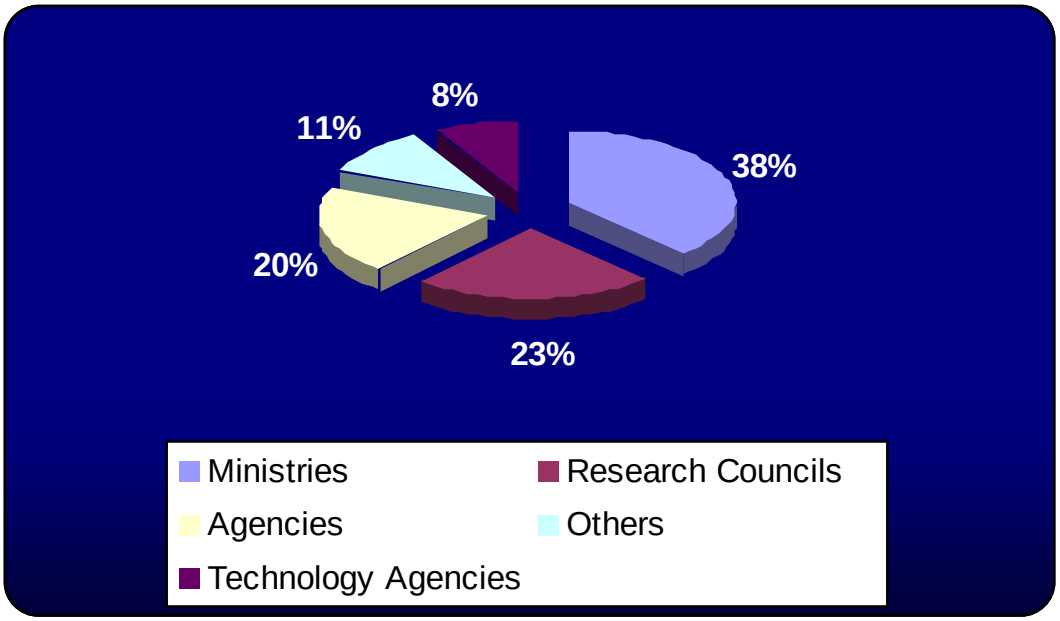

Figure 14: Participation in ERA-NET schemes

The vast majority of country representatives were from the EU-25 countries (87%). 37% of the overall total coming from the five largest economies (Germany, France, UK, Italy and Spain) and 27% of the total came from the smaller economies with significant numbers of participants (the Netherlands, Belgium, Sweden, Austria and Finland). 23% from the remaining 15 EU-25 countries, 10% of the total came from the Associated States and Associated Candidate States and the remaining 1% of the total came from the Third Countries.

In these terms, Germany leads the way, having participated in 61 of the 71 full ERA-NETs. France comes second with 57 participations in ERA-NETs. Germany also had the greatest number of representatives per ERA-NET (1.8), presumably a function of the diverse set of national and regional actors involved in the governance of the research system. Seven countries were selected to from big and small countries to comparison. In the following graph can be seen the difference of Germany and France from the other two big countries like Spain and the UK. Among smaller countries, participation in the projects is higher for northern states like Sweden, which

competes with digger states, meanwhile Greece and Portugal have limited participation in the projects (see Appendix III for the full list of country participation).

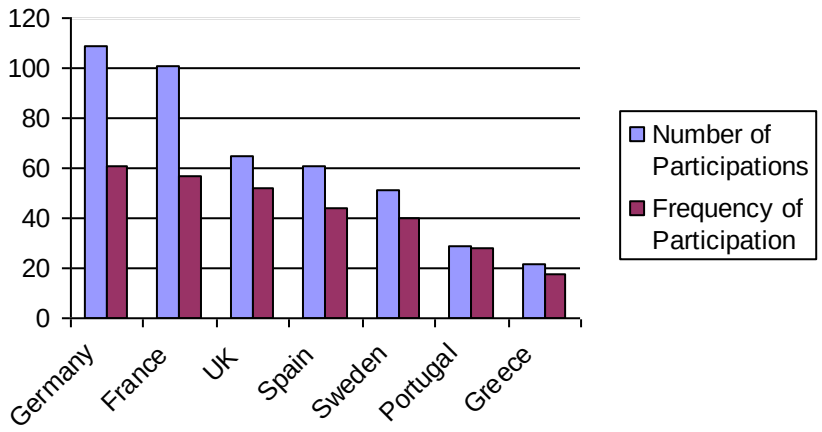

Figure 15: Number and frequency of participation of seven selected countries.

In the 7th Framework Programme, the European Commission continue to support the ERA-NET scheme. New ERA-NETs will be expected to follow the same four-steps as before. Participants with prior experience of ERA-NETs will be expected to move straight to the final step, the implementation of joint calls and programmes. The scheme will also be complemented by a new initiative, ERA-NET PLUS. In this, the Commission will contribute to the costs of the research projects selected as a result of a limited number of 'one-off' joint calls.

Recognising that networking is one of the most effective and symbolic ways of creating the European Research Area, European Commission promoted networking to promote the joint implementation of trans-national research programmes and taking specific action dedicated to the co-ordination of national and regional programmes. But this is not enough as it is needed extra motivation to pull programmes ahead. With the introduction of Article 169 of EU allows for the participation of the European Commission, as an equal partner, in new research and development programmes undertaken together by several Member States. The main objective here is to go beyond mere coordination of national programmes to achieve an integration of the different national and regional programmes in a single joint one. Article 169 programmes must be initiated by a relevant number of Member and Associated States,

to ensure a sufficient critical mass. They will be jointly implemented and funded by integrated financial support. In this case, the EU will contribute to this integration by funding the joint research programmes. A first Article 169 action, the European and Developing Countries Clinical Trials Partnership (EDCTP), was launched in June 2003. Under FP6, particular efforts have been made to activate this mechanism as a means of reinforcing European research collaboration, and half a dozen programmes are being proposed by Member States to be funded under FP7.

Consequently, the ERA-NET PLUS scheme provides support for new ERA-NETs as well as for the broadening and deepening of the scope of existing ERA-NETs and provides additional EU financial support to those participants that create a common fund for the purpose of joint calls for proposals between their respective national and regional programmes. Its objective is to encourage the pooling of funds in joint calls from national programmes on a 'call by call' basis. Through this new mechanism, the Commission could provide up to an additional 25%-30% of the total of national contributions. ERA-NET PLUS is bridging between ERA-NET and Article 169 by deepening the action in order to cope with a wider range of activities of coordination, collaboration and co-funding topped up by EU funding. In the table bellow, ERA-NET scheme is compared with other programmes supported by the commission and can be seen the complementarily of the programmes in all the levels of European research.

	COST	**EUREKA**	**ERA-NET**
Objectives	Coordination of scientific activities carried out by researchers	Coordination of industrial projects	Coordination of national programmes
Fields	All	All	All
Activities supported	♦ Scientific coordination activities (E U) ♦ Research at national level	♦ Only EUREKA Secretariat (E U) ♦ Research at national level	♦ Strategic coordination activities related to coordination of research programmes (E U) ♦ Research at national level
Participants	Researchers from Universities & Research Institutes	Researchers from Industry (SMEs) & Research Institutes	Programme Managers & programme makers
Deliverables	Joint scientific activities	Joint industrial projects	Transnational joint programmes
Evaluation	Technical Commitee « TCs »	National programme coordinators « NPCs » at National level	« Peer review » at European level

Table 2: Comparison of ERA-NET Scheme with other programs

The ERA-NET scheme is considered nowadays of having completed the targets set and had a big success as it has helped to move closer towards the creation of the European Research Area. It is overall accepted that the 'bottom-up' nature of the initiative was much appreciated by the main stakeholders and has helped the whole process. The use of Specific Support Actions as well as Coordination Actions allowed for the possibility of initial exploratory approaches. The adoption of a four-step process for participants, with the latter two steps non-mandatory, was entirely suitable for this first, experimental phase of ERA-NET. The flexible approach to the use of different funding regimes for joint calls encouraged participants, to join in and to explore ways of overcoming some of the practical barriers to the implementation of joint actions. In addition, it is encouraging that all member states involved and various geographical grouping was formed. On the other hand, no funding for joint actions was perceived as a weakness in the first stage of the programme but this seem to be resolved after the launch of ERA-NET PLUS. However there is concern over the big involvement of the Commission in the ERA-Net process itself as this would damage the started process of convergence so far. Also, should be promoted and supported more participation from the smaller and less development states of the EU in order to avoid the creation of a big states research area instead of an ERA. Towards that direction renewed strategy discussion at the highest levels should be introduced to stress the importance of trans-national activities within the context of all national policy portfolios. But smaller states too should be more aware and active in order to involve more in the new formed structures taking part in the EU. More actions should be taken by the EC also towards the synchronicity of the ERA-NETs and the ERA in general. The 7th FP should be the most important step towards the creation of the ERA as it is a general demand from all the relevant actors.

3.2.7 Regional Development and 4th Community Support Framework

European Union is one of the richest parts of the world but this does not mean there are no internal disproportions between its regions. The so called Europe of various velocities is a reality. Especially after the entry of ten new member countries of the east, whose the income of their citizens is below the European average. However, there is a group of countries in between as it has been mentioned, the countries of the south, old member of the union who try to reach the high European

standards of the countries of the north. Regional policy of European Union transfers resources in poorer areas in order to decrease the gap and force the economic integration.

Solidarity and cohesion between the state members aims to increase the prosperity levels between and within the state members. Dynamic urban regions have a far better GDP per capita than the least developed regions in the Union. Membership in the Union has proved that the gap can be limited and the living standards can increase. The example of Ireland, which its GDP was one of the lowest when entered the Union and now is one of the highest in the Union, is particularly promising. The priority of the European Union is to bring the living standards in the same level in all the Union. There are various reasons for the cause of the inequality, social and economic reasons, geographical remoteness, cause various disadvantages higher unemployment, limited investments or inadequate infrastructures. Four structural founds from the European Union, during the past years, targeted the decrease that gap. a) The European Regional Development Fund; b) The European Social Fund; c) The section of the EU's common agricultural fund devoted to rural development; and d) Financial support for fishing communities as part of the common fisheries policy (CFP).

The cohesion found by that period, financed transport and environment infrastructure in the countries with GDP less than the Union's average, in that case Greece, Spain, Portugal and Ireland. Ireland exposed a strong economical performance since then which returned to increased benefits for its economy and its citizens, but the three southern countries still receive founds in order to reach the European average. Consequently, the question is "what is going wrong in the south of Europe and why they expose less developmental speed?" The new integrated regional policy will distribute €308 billion to member states' regions with need, for structural and cohesion funds. The biggest ever distributed in the Union. 79% of the total amount will go for the reduction of the gap between poor and rich regions in the union. 17% for the competitiveness increase of the poor regions and job creation. The remaining 4% will be distributed for the strengthening of the cross-boarder cooperation between frontier regions. The southern countries have their last change to benefit and decrease the gap with the countries of the north. If not, they will watch the new member countries to accelerate their developmental rate and living behind the old southern members of the union.

The non-human elements, according to ANT have a high ability to act and interact creatively with the other elements. Lots of heterogeneous elements participate and contribute in the transition towards a highly competitive, innovative and knowledge-based Network State. ANT calls those elements "actants" which highlights the active nature of all the elements comprising the network (Latour, 1987). This collective action though seems that has not been black boxed. For the big amount of people though it is black-boxed, as when they hear development, growth, innovation, they do not really understand how those things are working or how they are achieved. This black box it opens though when things are not going well. When the agreed process are not followed and results cannot be seen in matter of convergence, growth or development the actans become visible. The governments that are unable to promote reforms, institutions that are resistant to change, actors like universities that do not play the role they should play in the process, citizens and organizations that react to reforms or are unable to actively participate etc. The reduced capacity of the relevant actants to act and contribute to the collective action then, becomes visible (Jasanoff, 1994; Wynne, 1988). During this period when problems evoke and the unity of the network is not as expected, becomes visible the black-boxing of the process and the artifacts, that have as result the reduced diffusion of knowledge, innovation or reforms.

3.3 LOCAL GOVERNMENT (Greece, Spain and Portugal)

The results for the countries of the south are not yet very prospectus as it has been shown before. In the graph below published by OECD is shown the poor growth in the countries of the south and the extraordinary performance of Ireland. More statistics demonstrate various trends. For example, Greece holds the last position among the member states of the EU in governmental aid (public assistance) with 0.2% of the GDP (400 million euros for 2005) when the European average is 0.6% and when Spain spent 4 billion euros. 97% of it was allocated for regional development and employment though. Out of this percentage only 3% was given for R+D when the European average is 12%. For support for the SMEs was given only 5% when the average in Europe is 10% and for training 0%! Generally, most of the governmental aid in Europe is spend for the rescue and reformation of problematic companies,

characteristically, Germany spend 64 billion euro for this purpose, when Greece spend only 110 million euros.

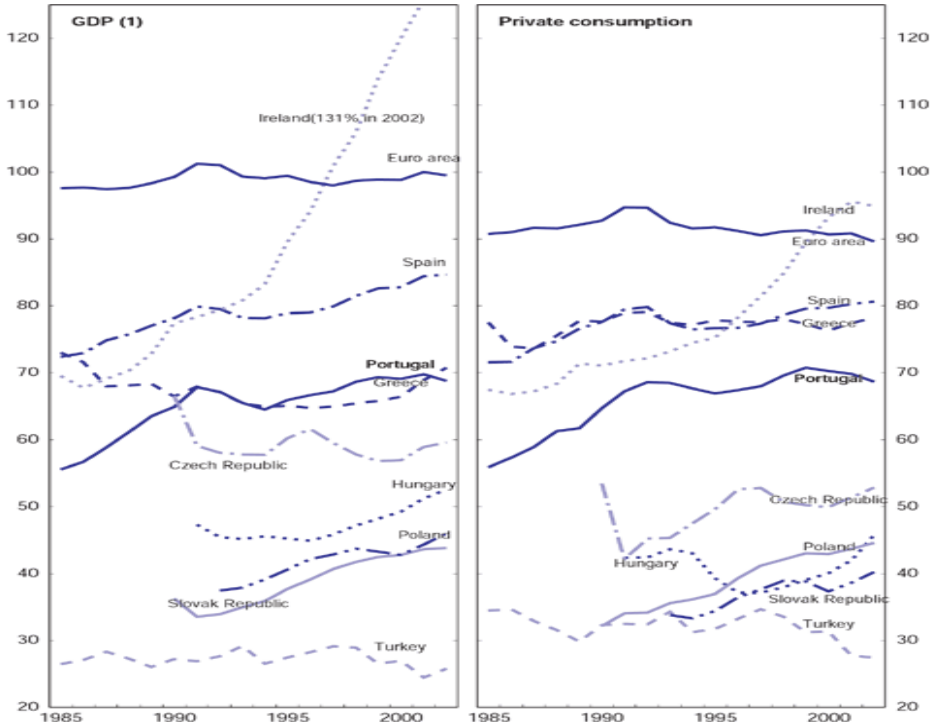

Figure 16: GDP and private consumption trends

The results of the counties efforts are better represented in the report of OECD (2006) "economic policy reforms: going for growth 2006" by country. The international organization conclusions about Greece reforms say that even though economic growth is fast "*the gap in GDP per capita with best performing countries remains large due to productivity and labour utilisation shortfalls*". Among other recommendations about reforms in pension system and employment protection legislation based on priorities supported by indicators OECD proposes reduction in the barriers to entry in network industries, and stresses that "*despite substantial progress in privatising state-owned enterprises, the government retains a large stake in major utilities and competition is still limited in key network industries, adversely affecting economy-wide efficiency*". However, praises the actions taken by the Greek government with the introduction of two laws that provide complete liberalisation of the electricity market from July 2007 and for the gradual liberalisation of the natural

gas market. Furthermore, it recommends that "privatisation limits should be abolished for all public enterprises. Assuring competition in the newly liberalised markets should be given high priority, particularly through strong and independent regulators and a reduction in vertical integration, where appropriate". Continuing OECD sets the key priorities for the Greek government which are relative to higher education system reforms and call the Greek government to "*make the higher education system more efficient, raise its standards to international levels, by introducing performance-based funding and by allowing the establishment of private universities*. *Also, impose limits on the study duration and consider introducing study fees accompanied by a loan-scheme with income-contingent repayments*".

Another report, the EC's forth report about the results of the economic and social cohesion in EU gives three basic conclusions about the Greece. States that Greece is one of the most benefited countries of the community's regional policy, that regional authorities do not manage well the money for the regional policy and the percentage of poverty among the population has not been reduced at all, and moreover an unemployed and a worker has the same possibilities to find its self below the limits of poverty! Greece would have 2.8% less GDP if the third Community Support Programme would not have existed for the period 2000-2006. For the period 2000-2015, EC predicts that the country's GDP will increase 3.5% and will be created 95.000 new working positions, but around the 20% of the population will remain around or below the poverty levels. The prime minister of Greece though, Konstantinos Karamanlis assured that reforms will keep taking place in order to exploit all the opportunities of the 7th framework programme.

Concerning Spain, during the twentieth century demonstrated very rich developments in arts, and literature but very poor results in science and engineering (just 2 Nobel Prizes). Since the 80s it is observed a radical change though. Spain has developed a lot since the era of Franco and its entry to the EU has been an important reason for that. However, did not manage after its entry to get into the first division of the European countries. The OECD report about Spain says that even though "*the convergence vis-à-vis best performing countries has continued in recent years, the substantial productivity and labour utilisation gaps remain*". Among other recommendations about reforms in employment protection legislation purported by the indicators OECD calls the government to strengthen the competition in the retail distribution sector. They should battle the restrictions "*created by regional*

governments on the opening of new outlets impede competition in retail distribution, contributing to weak productivity gains and excessive profit margins in the sector". It is recommended the elimination existing restrictions at the regional level taking advantage of the new EU Services Directive. In continuation, it recommended "*the improvement of human capital formation and the reform in the higher education system by giving more independence to universities and making them more accountable for their results, which should be made easily available to teachers, students and employers*".

A number of steps have been taken from Spain in order to move closer to the rest of Europe. The Ministry of Science in 1986 introduced the "Ley de la sciencia" (Science Law) in order to recuperate the broken tradition lost, as Spain is a country dedicated to development and ready to contribute in the EU, is said by the minister in the International Conference "The Knowledge Society" in Madrid. Science and technology is a priority for the Spanish government, 80% of the agreements of the government are about science and technology. However, they identify a big problem for that process, coordination and fragmentation of the initiatives (at it has been showed above OECD), as Spain has 17 autonomies. The priority of the country is said would be to give priority in the liberation of the universities (the universities have to become active actors). It has been created the "Estatuto" (statute) of the universities and the "Estatuto" of investigators, towards the creation of the knowledge society in Spain. The minister stresses that there is a mutual uncertainty in Spain and this has to be over-passed if Spain wants to become an innovation country and increase the R+D in the universities. In order to achieve the attitude change, Spain offers two programs to assist in that task, PROFIT [12](Program of Promotion of the Technical Investigation) and CENIT [13](National Centre of Technological Innovation). In the same conference, the business sector stresses that companies have to be innovators because it is an obligation and not the followers of the rest in EU, there is need for businesses to push the innovation in the country, they say. In the 7th FP there are diverse helps in the programme and everybody fits into it, with more sources to subsidy projects and initiatives in R+D and innovation. Ten other countries in the EU are more competitive than Spain but ironically they do not have the support and the experience that

[12] http://www.mityc.es/profitTIC/
[13] http://www.cenit.gob.ve

companies in Spain have. COTEC[14] (Foundation for Technological Innovation) on the other hand says that the FP7 defences the big industrial companies, for example Daimler-Chrysler has received the digest amount of support from the FP than any other company and argues that all the papers before made by Spanish government were just bureaucratic and stresses the need for the companies to be ready and connected. The government cannot back up the companies and on the other hand to wish global competitiveness. It is needed coordination in the way OECD states and calls the government through the new proposed National Plan to focus in R+D innovation in a way that will break down the ancient ties; it does not need to be depended to the companies.

The report about Portugal is moving more or less in the same mode, stating that the "*convergence in living standards with the OECD average has halted in recent years, with the large GDP-per capita gap essentially reflecting low productivity*". The primary recommendations for Portugal call for improvement of upper-secondary and tertiary education attainment, and focus on the low human capital accumulation limits productivity growth and that hampers the adoption of new technologies. The importance of reform in the tertiary education system is stressed and welcomes the launched programmes to reorganise and rationalise the tertiary education system but should be "*continued the ongoing efforts to strengthen vocational and technical education*". The reduction of barriers to competition which results to weak competition in network industries and the services sector which hamper productivity growth is another important point for policy, which by the way, has not make important steps since the establishment of the independent Competition Authority in 2003.

Overall, the report for those countries calls for significant further reforms to ensure that good performance is sustained in the years to come, and tackle weaknesses in product and labour markets. But above all it is stressed the importance of reforms on the tertiary education and the weak competence in southern network markets as the economies are moving towards the knowledge based economy. Autonomy and liberalization of the universities is of high priority for southern countries as it appears from the above report. A question about the southern countries is if they really want to innovate and develop.

[14] http://www.cotec.es/

For ANT, society must be composed, made up, constituted, established, maintained and assembled, but primarily ANT stresses the role of non-humans on that process as we have mentioned above (Callon, 1986; Latour, 1987; Law, 1987). By that, the topic of analysis if directed to institutions, organizations, or rules and procedures of the process, which of course are human creations (Callon, 1986). All if those non-human elements act and they have a relevant spokesperson always. The European society then has been replaced by a collective made by humans and non-humans (Latour, 1993) with numerous consequences. In micro level there are only interactions between humans but those interactions exist only within a framework that has been designed to contain them. In order to exist interactions between managers of companies for example, towards cooperation much exist a framework which will protect, promote, supervise, guide, subsidy, authorize certain activities, create clusters etc, of which without those actions these interaction can not exist (Goffman, 1974). Those interactions happen locally (another term introduced by ANT) and directly define the place and the interactions of the place with other places (Latour, 1986). When the institutions prohibit or does not facilitate those interactions to occur, the company does not expands, the university shrinks, the government does not develop, the GDP per capita decreases etc. and the malfunctioning framework of the locality has multiple consequences in European level and not only locally, as the asymmetries in localities have consequences in the power relations between all the localities (Latour, 1991; Callon, 1991). The more a place is connected to other places though science and technology, the greater its capacity for mobilization (Callon, 1999). ANT stresses the importance of the process of constitution and extension of these networks based on the concepts of translation, interessement and the spokesperson (Callon, 1986) which explain the progressive constitution of those heterogeneous assemblages (Callon, 1986). At this point we will stress the important role of the university as an institution with a significant weight for the diffusion of knowledge in all the level of the society.

3.4 UNIVERSITIES AND THE BOLOGNA PROCESS

Commenting in the London ministerial meeting, the European Commissioner for Education, Training, Culture and Youth, Ján Figel', said: *"Bologna reforms are important but Europe should now go beyond them, as universities should also*

modernise the content of their curricula, create virtual campuses and reform their governance. They should also professionalize their management, diversify their funding and open up to new types of learners, businesses and society at large, in Europe and beyond. Countries should modernise their higher education systems in all their areas of activity - education, research and innovation - making them more coherent, more flexible, and more responsive to the needs of society. These would be great steps towards the goals of the European Higher Education Area as well as the European Research Area". The target have been set and are very prospectus, it remains now all the relative actors to coordinate and put the most of their efforts to accomplish it.

The reform of educational system in the south could give the answer in the problems of slow developmental results in a long turn. We believe that the activation of universities as a major actor in the society could lead to overall activation of all the society. The importance of universities is very big as universities enclose all cultural and scientific accomplishments, the birth of new technologies, electronic reviews, data bases and more, but reforms should go further the Bologna Process as has been stressed above by the commissioner. Universities are the core of public sector research and as OECD and the Triple Helix dictates; the *university-industry collaboration* is one way road to benefit both from the tacit dimensions of knowledge. Promotion of start-ups for breakthrough knowledge (Etzkowitz, Webster and Healey, 1998) should lead towards an entrepreneurial university. The actual situation implies three missions for the universities which have to go through strategic agreements between universities and companies; generation of knowledge in network, transfer of technology, towards enterprises and externalization of the R+D activities through the companies. According to COTEC, 50% of the investigation in FPs is made by the universities, mainly in topics where in Spain there are no established companies yet. The cooperation was with companies from abroad, that means knowledge is growing outside Spain and has not local importance and they call for research that is related with the society. The challenge for the university is to be engaged in all three missions, with both excellent and relevant (problem solving in relations with actors) research. The problems are not only economic, are social too. Above all and in order to move towards the targets set, there is a need to measure the *intellectual capital* of the universities and introduce indicators in order to become comparable the tertiary education. The knowledge-based society requires educated citizens and workers that

is why the EU wants half of an age class in higher education. Towards that direction we need to have tools of analysis. Intangibles and intellectual capital are key features especially now that one sector invades the terrain of the other (the Triple Helix). Because of that there is an increased preoccupation of measuring irrelevant things (Cañibano and Sánchez, 2004). As universities are moving towards the third mission more indicators need to be measured. Some actions on process include the RICARDIS (2006) programme and the PRIME Network of Excellence[15]. More steps towards the autonomy in the decision making of the universities should be taken and this is a very important issue for the southern countries. Although political actions can help towards that direction just a law does not solve all the problems and furthermore reforms have high political costs which make them difficult to occur. That is why any change should be a well planned action after a national agreement and participation from all the society (collective action) which will guarantee the success of the reforms (Cañibano and Sánchez, 2004).

In continuation and as a consequence of Bologna Treaty it is important to know the *intellectual capital* of the universities, in order to have a transparent system on the universities and the companies to know where the money invested are going, but at the moment only Austria obligates universities to provide information in the government about their intellectual capital. In order to develop and grow we have to "speak the same language", the indicators used have to be defined with maximum precision in order to know what exactly we have to measure. The manuals of OECD try to solve that by publishing papers that define the indicators with precision. All the above are useful tools for transparency and the information of the society on one hand and on the other hand in order to manage correctly the recourses. However, there is need for diffusion and promotion by all the actors, universities, companies, government as till now it is voluntary in all countries apart from Austria. Another important factor what will help to reach the above objectives is the posterior evaluation in all levels, local, regional, governmental and European. The only university evaluation nowadays is the Shanghai ranking.

The most important actor in European level which works for the networking of universities is the European University Association (EUA)[16] with 800 members

[15] Prime is a network of excellence to develop long-term research and shared infrastructures on policies for research and innovation in the move towards the European Research Area (ERA). http://www.prime-noe.org/
[16] http://www.eua.be

(Appendix IV) and with policy focus in ERA and EHEA (European Higher Education Area). In the conference “Knowledge Society” they denote that higher education remains predominately a national responsibility, but the Bologna Process (45 members) and the Lisbon Strategy (EU27) calls for more coordination and participation. On the other hand, they stress the limited responsibility of EU for higher education. It is proposed that the new EU policy issues have to focus on the university-enterprise cooperation, knowledge transfer, regional knowledge through the 7th FP and the Bologna Process. The General Secretary of EUA, John Smith, during the conference “Knowledge Society” denoted that EUA works to link Bologna and Lisbon Strategy, based on Doctoral Programme Reform, but there is uncertainty over the financing in the European Universities even in the countries of the north. Concerning regional policy and regions of knowledge, they say that universities are not yet seen as an important stakeholder, but they incredibly fast change their structures and are improving in every field. Southern countries should see that and move fast. Universities are expected to become more specialised in the future but they will not be diminished. The proposal of EUA is the creation of ERA UNI-NETS in the EC, in order to be involved in projects that are already on going and coordinate their actions.

In Greece there are actors that stress the above objectives and the road map to be followed but are not followed by the relevant reforms. The 54th Summit of Rectors in Greece calls the government to include the universities in the institutional prevision of the government for the establishment of research centres. It is underlined that has to equally adjust the interactive functionality between research institutions and Universities, in concerns of excellence, infrastructure and human resources. Additionally, they call the government for the analogical participation of the Universities in the final operational structure of the *National Strategy for Research*. Even though, the Summit stresses the importance towards the right direction of the reforms regarding the research, it underlines that the important role of the universities is diminished, the time that universities have invest in the interaction of research and education. The New Law for Research and Technology should target towards the amplification and not the decrement of the research activities of the universities. Concluding, the summit asks for the embodiment in the New Law of the prevision of the European Commission for the Universities, as institutions that promote "the knowledge-based society" and reinforce their social and research projects. In short

they ask the self-evident according the Bologna Process but the reforms in Greece are slow. In response the Minister of Education, Marietta Giannakou, declared the determination of the government to apply the new law-framework for the tertiary education, which is expected to hand in for approval in the Greek parliament, and promotes radical changes in the way the Greek universities work, in order to amplify the prestige of Greek universities. Towards that direction, announced the financing of 420 million euros from the 4th Community Support Framework for Research in the Universities through the Ministry of Education. The Minister stressed that 80% of the research projects in the country comes from the universities, and stressed that in cooperation with the Ministry of Development, universities should have higher institutional involvement in the research programmes and an interactive relation between research institutions and universities.

The importance of the above proposed reforms in tertiary education is highlighted by the following statistics. Greece comes first in the EU27 in the *unemployed graduates* of tertiary education according to the European Commission, with 7%. Second in the list is Spain with 6.1%. The percentage of graduates in Greece is 20.6% and in Spain 28.2% when the European average is 22.4%. On the contrary Finland has the highest percentage of tertiary education graduates (34.6%) and the unemployment rate among them is 4.4%. Ireland has the smallest percentage of unemployment among graduates in the tertiary education (2%) and an overall percentage of graduates 29.6%.

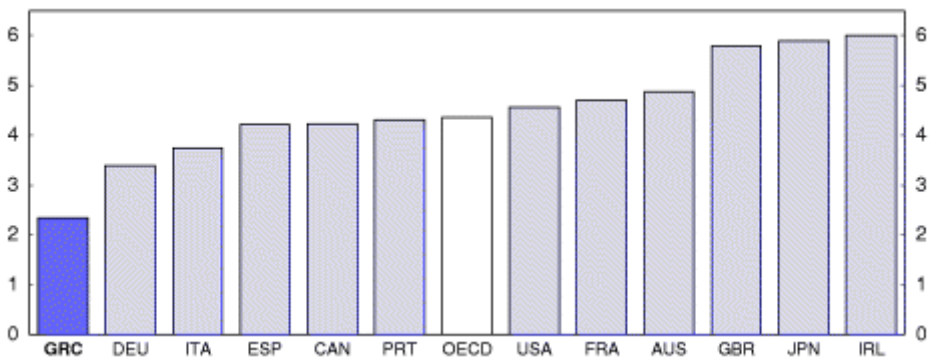

Figure 17: New tertiary graduates as a share of the population aged 20-29, OECD.

The data clearly demonstrate that tertiary education is not well related with labour market in Greece. There is an increased necessity for southern countries to

further reform their tertiary education sector in order to connect universities with production. Especially now when the *biggest growth is observed in the education services* according to OECD. Over two million students study abroad of their birth countries and the market they represent is of a worth of thirty billion dollars or 3% of the world export services. According to the predictions, in twenty years the number is expected to over-double reaching the number of five million students. However, the key to the export of students is the international language taught in the universities. In the pubic institutions in Greece and other southern countries, there are not yet courses taught in English, even though other private education institutes attract international students in Greece their degrees are not qualified by the Greek government. Around 20% of the new registrations in the private collages come from abroad. In order to increase the amount of foreign students the state has to support the effort and get advantage of its geographical position, based on the example of Australia that managed to become the first country globally in the exportation of educational services.

In short, the universities should have a fundamental role in the economical growth of the society and this is because we should construct a Europe based on knowledge which is a key factor for growth and in accordance with the Lisbon Strategy, the Bologna Process, the Maastricht Treaty, and find equilibrium between economy and society. Improvements in tertiary educational system should target the human capital needs and reforms should decentralise tertiary education which will lead to more flexibility and autonomy for universities, especially in the countries of the south (OECD). **"***Strong and creative universities for a strong Europe"* (Glasgow Declaration, EUA, 2005) is the catchword given by the EUA, in order to become the universities the key actors in the process of the transformation of the results of the investigation in products. In one site there is scientific cooperation in Europe and on the other there is the global competitiveness with uprising economies and we stand in a crucial crossroad where either you get the train or you loose it.

CHAPTER 5 – CONCLUSIONS

European Union with the use of indicators and statistic opened the black box of development in the Union but for some countries the black box still remains… black. Local governance in the south is problematic, but have to keep serving their role

meanwhile the Central European governance appears to substitute it with clearer objectives and more determination. The problem is identified in the way south and north works. The Irish have managed to achieve very high and rapid growth than Spain, Greece, and Portugal and finally leave them behind. “Science has two faces: one that knows and the other that does not know yet” (Latour, 1987). Rephrasing this saying we could say that Europe has two faces, the one who knows how to apply and the other that doesn’t or cannot. Unavoidably, the actants in a particular point they all become visible when things go wrong.

The EC and the governments, through the various reports and researches that assemble, see entities and relations that no one else can see or assemble (Callon 1999). Both translation centers should take action and mobilize large number of human and non-human entities who actively participate in this collective action (Callon, 1999). However, there is inertia or inability from the local southern governments to take those actions in contrast to the EC who promotes it very actively. A single place can have access to other places and act on them (Callon 1999), is what EC actually does, but not all local governments participate actively on that, or still can not do it. The problematisation of the local actors is low, when they should have embody their role and mobilise all the allies to achieve their target as it should have been according to the translation from the EU and its effort to create a generalised symmetry based on indicators and statistic. The punctualization of the actors is of high importance as a weak actor (southern country) is the result of the other smaller and weaker actors that compound it (universities, companies etc). If all the actors are not synchronised then the actor-network goes down and the whole attempt for development or towards a network state is at risk. The Triple Helix and ANT tries to bind together all the relevant actors for massive improvement and involvement. The ANT is an open building site, not a finished and closed construction (Law and Hassard, 1999) and has inspired lots of organizational studies in an attempt to animate various entities till now, southern countries have to pay attention on those outcome.

Regarding to the first research question, it has been shown that increased participation in the network structures of the EU is a trend observed between the most developed, northern countries. Southern countries have minimal participation in the network structures of the EU analogous to their size. Spain, motivated by its potential as a new economical power in Europe and its volume tries to increase its participation in all the network structures of the Union which as a return is expected to shown

faster development and convergence in the near future. The exclusion of the country and from the Cohesion Fund is a sign of the improved position of the country. Therefore, the increased participation in the network structures of the EU helps the countries to achieve faster levels of development and convergence, but Greece and Portugal, still in the Cohesion Fund, demonstrate that their slow development is in accordance with the results of their limited representation in the Union's networks. OECD among others presses for increased scientific and technological cooperation and networking between companies and industries in the world of techno-globalisation. EUREKA and ERA-NETs were very successful bottom-up processes but were not enough for the development of all the actors, even though they move towards the right direction. Meanwhile other countries benefit from those structures others either hesitate or they have very limited participation on those networks. A top-down process could balance this disproportion among the states and be of great benefit of the states will limited participation. At the rest of the world where cooperation in science and technology is promoted results can be seen, meanwhile others cannot still apply it locally neither to increase their participation in networks. With the publication of country reports OECD, EU and other organizations, make an effort to press the southern countries to promote reforms towards more cooperation, involvement in networks, liberalization of their markets and more autonomous and entrepreneural universities, in an effort to decrease the weak competition in southern network industries and universities.

As regards the second question, the slow adaptation of the EU's strategies and targets by the counties of the south reflects the problem of coordination and cooperation among the actor in the local societies to act together. And furthermore demonstrates the lack of vision for the future and the practice of old and conservative policies from resisting institutions in the south of whose mental models remain still solid. The southern countries have to take their chances towards better practises in governance. This thesis has raised a policy question also about the success of the financial support in the Union and if this is enough. Money is never enough if they are not invested wisely. Actions like, close monitoring and press towards application of better practises, support for participation in networks etc. are essential from the Union in order to keep the chain together and strength the core and the periphery of the Union. The EU has taken the necessary steps to confront the main weaknesses in science and technology and battle fragmentation (Foray, 2004) but embeddedness

needs to be ensured and the social capital of the Union has to be strengthened based on frequent interaction and trust (Burt, 1997a; Burt, 1997b). Concerning the policy question, the new countries in the EU unquestionably will move faster towards development and convergence as the example of the south and the lessons learned will help those countries to network faster themselves and increase the connections and interaction in all levels. Some countries, like Hungary and Czech Republic, have already put action the Triple Helix model in action and universities are playing a fundamental role in the society and in economy by promoting the right policies and coordinating their actions.

There is no doubt that this thesis has stressed the importance of the good cooperation between government, universities and companies in its attempt to answer the third research question, and especially the important role of the university towards the knowledge-based society and better innovation diffusion in the society. Still the Triple Helix model does not work properly in the south; its application in Europe has shown that can help the society to benefit from that cooperation of the most important actors. Universities and networking could help the southern countries to bridge the gap between south and north if the local institutions will allow them to do so. OECD and EU, among other world players, press for a more active role of the tertiary sector in society and economics which crashes in old regulations of regional institutions in the local governments. There is lots of work yet to be done for the harmonization of the southern educational systems with the northern and good will and pressure should resist to the conservative powers and the established powers and guilds. Universities here have a big role to play, they are the only ones who can do it and deliver the knowledge to the citizens by using the IT and gathering citizens and companies around, they can release this information faster and thought that educate and involve all the society. It is the traditional actor who delivers knowledge to the society. Time changes and universities need to accept the new position offered by the globalization and be the most important node, transformed in the most important actor-network who will lead towards the improvement of the society in all levels.

With the use of ANT, the Triple Helix model and the concept of networking this thesis shows the direction all the actors should move, if convergence and development, in economical or social terms, is their objective. Cooperation and coordination are the key words of this century. Cooperation between the member states, citizens, companies, universities or any other actors do not happen if there is

not a strong political wheel. In the EU there is lots of will as it has being demonstrated, the citizen's attitudes are favourable also, in between there are resistible institutions, conservative thoughts, and mean interests that do not share the same will. That leads to limited representation and participation in European, international or even national corporations. With the position of universities in the frontline of economic and social development even the most resistible forces will be removed as the history has demonstrated. The Triple Helix tell us about the important role of the internal transformation of each helix and the influence of one upon the other, when in the south we see nothing of the above. The examples of trilateral linkages, of Silicon Valley and Finland lead to inter-institutional networks which head organised towards common targets as the overall economical development for example. Investment in knowledge through cooperation of all actors is the new catchword. More aspects other than technological have to be taken into consideration, due to the heterogeneous nature of technological and economical change. Efficient regulations need to be promoted (Kemp, 2000) towards the targets set by the EU for innovation. Institutional change is of high importance if government wants to influence the technological change and reach targets related with economical development and knowledge-based economy. The actors involved and the social interactions of that change must be synchronised and facilitated by the government in order to reach sustainability (Rip and Kemp, 1998). The governance issue is important and its result is of high importance towards the success of the knowledge-based economy. Instead of trying to control and dominate, government should facilitate the relevant actor to take initiatives towards the target set by the EU and OECD, let the actors to interact by giving them autonomy and let the market and the society to decide (Nelson and Winter, 1982).

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APPENDIXES

Appendix I

Table 7: Comparative analysis of innovation performance by country

		EU25	EU15	BE	CZ	DK	DE	EE	EL	ES	FR	IE	IT	CY	LV	LT	LU	HU	MT	NL
1.1	New S&E graduates	12.7	13.6	11.2	7.4	13.8	9.0	8.9	8.0	12.5	22.0	23.1	10.1	4.2	9.4	17.5	1.8	5.1	3.6	7.9
1.2	Population with tertiary education	22.8	24.0	31.0	13.1	33.5	24.6	33.3	20.6	28.2	24.9	29.1	12.2	28.8	20.5	26.3	26.6	17.1	11.4	30.1
1.3	Broadband penetration rate	10.6	12.0	17.4	4.3	22.0	10.2	11.1	0.8	10.0	13.9	4.4	9.5	2.7	3.7	5.0	11.7	4.5	10.4	22.4
1.4	Participation in life-long learning	11.0	12.1	10.0	5.9	27.6	8.2	5.9	1.8	12.1	7.6	8.0	6.2	5.6	7.6	6.3	8.5	4.2	5.8	16.6
1.5	Youth education attainment level	76.9	74.1	80.3	90.3	76.0	71.0	80.9	84.0	61.3	82.8	86.1	72.9	80.7	81.8	85.2	71.1	83.3	48.1	74.6
2.1	Public R&D expenditures	0.65	0.66	0.57	0.50	0.76	0.76	0.50	0.42	0.51	0.79	0.43	0.56	0.28	0.34	0.61	0.21	0.50	0.19	0.76
2.2	Business R&D expenditures	1.20	1.24	1.29	0.92	1.67	1.76	0.42	0.20	0.61	1.32	0.82	0.55	0.09	0.23	0.16	1.34	0.41	0.45	1.03
2.3	Share of medium-high/high-tech R&D	--	89.2	79.5	85.4	84.7	92.3	62.0	--	77.0	86.8	85.0	87.8	70.6	77.8	70.8	--	87.8	86.7	87.9
2.4	Enterprises receiving public funding for innovation	n/a	n/a	11.7	6.1	7.8	9.2	0.3	10.4	9.0	6.6	27.8	14.0	16.3	2.0	3.6	39.3	5.7	3.5	12.9
3.1	SMEs innovating in-house	n/a	n/a	38.3	25.2	16.1	46.2	29.8	17.5	24.3	29.2	47.2	31.0	--	15.2	22.1	39.2	17.0	2.9	34.2
3.2	Innovative SMEs co-operating with others	n/a	n/a	16.6	12.9	20.8	8.6	16.0	8.4	5.7	11.5	15.6	4.3	16.5	6.1	14.8	14.8	6.6	5.3	12.3
3.3	Innovation expenditures	n/a	n/a	1.96	2.15	2.40	2.93	1.59	3.08	0.94	2.23	1.68	1.81	2.92	2.26	1.57	1.62	1.16	1.08	1.25
3.4	Early-stage venture capital	--	0.023	0.019	0.000	0.068	0.015	--	0.001	0.011	0.026	0.021	0.002	--	--	--	--	0.002	--	0.005
3.5	ICT expenditures	6.4	6.4	6.3	6.6	6.5	6.2	9.8	4.9	5.5	6.0	5.2	5.3	--	9.6	7.8	6.8	8.1	8.5	7.6
3.6	SMEs using organizational innovation	n/a	n/a	38.1	35.0	57.1	53.2	39.2	39.6	27.6	35.9	49.6	32.2	42.8	35.7	23.6	58.4	19.1	32.5	26.2
4.1	Employment in high-tech services	3.35	3.49	3.73	3.10	4.69	3.36	2.82	1.74	2.75	3.92	3.55	2.89	2.04	2.65	2.12	3.32	3.02	2.69	4.05
4.2	Exports of high technology products	18.4	17.7	7.1	13.7	13.3	15.4	10.1	7.1	5.7	20.1	29.1	7.1	15.9	3.2	2.7	29.5	21.7	55.9	19.1
4.3	Sales of new-to-market products	n/a	n/a	4.8	7.7	5.2	7.5	4.4	4.8	3.8	6.2	5.6	6.3	1.9	3.5	4.4	6.4	4.2	13.6	4.0
4.4	Sales of new-to-firm products	n/a	n/a	8.2	7.8	5.8	10.0	7.6	6.2	10.0	5.6	4.5	5.6	3.7	1.6	5.3	9.1	2.5	8.7	4.3
4.5	Employment in medium-high/high-tech manufacturing	6.66	6.71	6.51	9.42	6.29	10.43	4.75	2.13	4.68	6.34	5.99	7.37	1.19	1.52	2.57	1.38	8.19	6.63	3.30
5.1	EPO patents per million population	136.7	161.4	144.5	15.9	235.8	311.7	15.5	11.2	30.6	153.7	77.3	87.3	16.4	5.9	5.8	200.5	18.9	8.8	244.3
5.2	USPTO patents per million population	50.9	60.2	52.4	4.3	72.9	123.0	1.2	1.8	7.7	56.8	37.4	31.2	1.5	2.2	1.0	85.9	5.3	4.6	78.3
5.3	Triad patents per million population	32.7	38.9	32.0	1.5	32.4	85.2	0.0	0.8	2.7	36.5	14.8	11.6	2.6	0.3	0.6	41.8	1.9	2.6	59.6
5.4	Community trademarks per million population	100.7	115.7	92.2	25.7	159.8	140.5	31.7	27.7	140.9	76.0	143.0	92.7	152.6	12.2	14.7	782.7	18.8	118.9	141.0
5.5	Community industrial designs per million population	110.9	127.6	124.6	40.9	243.2	186.5	9.2	2.8	106.2	88.1	49.0	176.3	39.1	20.3	5.4	377.6	15.2	12.1	132.8

Appendix II

Table 1: 19 ERA-NETs in Environment and Energy Sector

Environment and Energy		DE	FR	ES	UK	SE	EL	PT	N
AMPERA	European Concerted Action to foster prevention and best response to Accidental MarinePollution		2	2	1			1	10
BIODIVERSA	An ERA-Net in Biodiversity Research (BiodivERsA)	1	2	1	2	3		1	14
BONUS	BONUS for the Baltic Sea Science - Network of Funding Agencies	1				3			9
CIRCLE	Climate Impact Research Co-ordination for a Larger Europe	1	3	ob		3		2	19
CRUE	Coordination of research financed in the European Union on Flood risk management	3	1	1	2				13
ECORD	European Consortium for Ocean Research Drilling	1	1	1	1	1		1	17
ERA-NET BIOENERGY	ERA-NET Bioenergy	2			2	1			7
EUROPOLAR	The European Polar Consortium: Strategic Coordination and Networking of European Polar RTD Programmes	2	1	1	1	1			19
EUWI	Coordination of Member State Research programmes in water science for the developing world				1				
FENCO-ERA	D Initiative for Fossil Energy Technologies towards Zero Emission Power Plant	2		1	1		2	1	12
HY-CO	Co-ordination Action to Establish a Hydrogen and Fuel Cell ERA-Net, Hydrogen Coalition	2	2	1		1	1	1	18
INNER	Innovative Energy Research	1	2	1	1	1		1	10
IWRM.Net-CA	Towards a European-wide exchange Network for improving dissemination of Integrated Water Resources Management research outcomes	1	1	1	1	1	1	1	13
MariFish	Coordination of European Marine Fisheries Research	1	1	2	2	1	1	1	14
MARINERA	Co-ordination of National and Regional Marine RTD Activities in Europe	1	2	1	1		1	1	13
NET-BIOME	NETworking tropical and subtropical Biodiversity research in OuterMost regions and territories of Europe in support of sustainable development		1	1	1				5
PV-ERA-NET SP1	Networking and Integration of National and Regional Programmes in the Field of Photovoltaic (PV) Solar Energy	4	1	1	1	2	2		13
SKEP	Scientific Knowledge for Environmental Protection – Network of Funding Agencies	3	2		2	1			11
SNOWMAN	Sustainable management of soil and groundwater under the pressure of soil pollution and soil contamination	1	1		1	1			7
		27	23	15	21	20	8	11	

Table 2: 9 ERA-NETs in Fundamental Research and International Cooperation

Fundamental Research and International Cooperation		DE	FR	ES	UK	SE	EL	PT	N
ASPERA	AStroParticle ERA NET	2	2	2	1	1	1	1	12
ASTRONET	Coordinating Strategic Planning for European Astronomy	5	1	1	1	1	1		18
Complexity-NET	Developing ERA-NET on Complexity			1	1		1	1	8
CO-REACH	Co-ordination of Research between Europe and China	2	3		2				8
ERA-ARD	The Agricultural Research for Development (ARD) dimension of the European Research Area (ERA)	1	1	1	1				14
ERA-CHEMISTRY	Implementation of Joint Bottom-up European Programmes in Chemistry	1	1	1				1	13
EULANEST	European - Latin American Network for Science and Technology	2	3	2				1	
EU-SEC	Coordinating National Research Programmes on Security during major events in Europe	1	1	1	1			1	10
SEE-ERA-NET (Env-Energy)	Southeast European ERA-NET		2				1		
		14	14	9	7	2	4	5	

Table 3: 8 ERA-NETs in Humanities and Social Sciences

Humanities and Social Sciences		DE	FR	ES	UK	SE	EL	PT	N
ERA-SAGE	European Research Area on Societal Aspects of Genomics	1			1				9
EURYI	European Young Investigators Awards	4	5	2	8	6	2	3	16
FORSOCIETY	Foresight and Society ERA–NET	2	2			1	2		15
HERA	Humanities in the European Research Area				1	1			
NEW OSH ERA	New and Emerging Risks in Occupational Safety and Health (OSH) Anticipating and Dealing With Change in the Workplace through Coordination of OSH Risk Research	4		1		1	2		
NORFACE	Dealing With Change in the Workplace through Coordination of OSH Risk Research	1			1	1		1	12
URBAN-NET	New Opportunities for Research Funding Co-operation in Europe A Strategy for Social Sciences	2	1		3			1	
WORK-IN-NET	Labour and innovation: Work-oriented innovations – a key to better employment, cohesion and competitiveness in a knowledge-intensive society	3				2	1	1	12
		17	8	3	14	12	7	6	

Table 4: 20 ERA-NETs in Industrial Technology, Transport, IST and Innovation

Industrial Technology, Transport, IST and Innovation		DE	FR	ES	UK	SE	EL	PT	N
ACENET ERA-NET	Applied Catalysis ERA-NET	2	1	1	1		1		9
AirTN	Aeronautics ERA-Net as one of the key enablers of the prosperous development of Aeronautics in Europe	2	2	1	1	1	1	1	17
COMPERA	ERA-NET on national and regional programmes and initiatives dedicated to the creation and support of 'Competence Research Centres'	1		3	1	1			
CORNET	ERA-NET Collective Research	3	1	2			1	1	17
ERABUILD	Strategic cooperation between national programmes promoting sustainable construction and operation of buildings	2	2		1	2			8
ERA-NET ROAD	ERA-NET ROAD – Coordination and Implementation of Road Research in Europe	1			1	1			11
ERA-NET TRANSPORT	ERA-NET Transport	2	2	1	1	1			13
EraSME	ERA-NET on National and Regional Programmes to Promote Innovation Networking and Co-operation between SMEs and Research Organisations	2	1	1		1	1	1	15
ERA-SPOT	Strengthening Photonics and Optical Technologies for Europe	1	1			1			6
ERA-STAR REGIONS	ERA – Space Technologies Applications & Research for the Regions and medium-sized Countries	4	1	2					9
ETRANET	ICT in traditional manufacturing industries ERA-NET	2	1	1	1	1			13
iMERA	Implementing Metrology in the European Research Area	1	1		1	1			13
MANUNET	Walking towards an European regionally based research area on new processes and flexible intelligent manufacturing systems	2	1	3	1		1		16
MARTEC	ERA-Net Maritime Technologies	2	2	1	1				9
MATERA	ERA-NET Materials	1			1				14
MNT ERA-NET	MNT ERA-NET From Micro- and Nanoscale Science To New Technologies for Europe	2	2	2	1	1			17
NanoSci-ERA	Nanoscience in the European Research Area	2	4	1	1			1	12
SUSPRISE	Networking, co-ordination, co-operation and integration of national programmes in the field of the Sustainable Enterprise “SUSPRISE”	3	1	1	1	2			9
VISION	Shared knowledge base for sustainable innovation policies					1			10
WOODWISDOM-NET	Networking and Integration of National Programmes in the Area of Wood Material Science and Engineering	2	3		2	2			8
		28	16	16	11	10	5	3	

Table 5: 15 ERA-NETs in Life Sciences

Life sciences		DE	FR	ES	UK	SE	EL	PT	N
ALLIANCE-0	European Group for Coordination of National Research Programmes on Organ Donation and Transplantation	1	1	1	1			1	7
CoCanCPG	Coordination of cancer clinical practice guidelines research in Europe	1	3	2	2	2			11
CORE Organic (Fund.Res)	Coordination of European Transnational Research in Organic Food and Farming	3	2		2				11
ERA-AGE	European Research Area in Ageing Research	1	1	1	1	1			13
ERA-IB	Towards an ERA in Industrial Biotechnology	1	1	2	1			1	12
ERA-PG	European Research area plant genomics	2	1	1	1	1		1	16
E-RARE	ERA-NET for research programmes on rare diseases	2	2	1					10
ERASysBio	Towards a European Research Area for Systems Biology - A Transnational Funding Initiative to Support the Convergence of Life Sciences with Information Technology & Systems Sciences	2	3	exp.	1				13
EUPHRESCO	Coordination of European Phytosanitary (Statutory Plant Health) Research	2	2	1	2		1	1	17
EUROTRANS-BIO (Soc. Sc)	EUROpean network of TRANS-national collaborative RTD for SME's projects in the field of BIOtechnology	2	4	2					9
HESCULAEP	Health emergency national regional programmes for an improved coordination in prehospital setting		2	2	1	2			8
NEURON		1	2		1	1			11
PathoGenoMics	Trans-European cooperation and coordination of genome sequencing and functional genomics of human-pathogenic microorganisms	2	3	1				1	10
PRIOMEDCHILD	Coordination of research on priority medicines for children		2	1	1	1			8
SAFEFOODERA	Food Safety - Forming a European platform for protecting consumers against health risks								
		20	29	15	14	8	1	5	

Appendix III

Table 6: Overall participation in the ERA-NET schemes by country

	Number of participation	%	Frequency of Participation	%
Germany	109	10.60%	61	86%
France	101	9.80%	57	80%
Netherlands	69	6.70%	56	79%
United Kingdom	65	6.30%	52	73%
Spain	61	5.90%	44	62%
Austria	58	5.60%	42	59%
Finland	50	4.90%	40	56%
Sweden	51	5.00%	40	56%
Belgium	50	4.90%	38	54%
Italy	48	4.70%	36	51%
Denmark (+ Greenland)	30 (+1)	3.00%	28	39%
Portugal	29	2.80%	28	39%
Poland	42	4.10%	27	38%
Ireland	20	1.90%	20	28%
Slovenia	20	1.90%	20	28%
Greece	22	2.10%	18	25%
Hungary	17	1.70%	17	24%
Czech Republic	16	1.60%	14	20%
Estonia	12	1.20%	12	17%
Cyprus	6	0.60%	6	8%
Slovakia	8	0.80%	5	7%
Latvia	5	0.50%	5	7%
Luxembourg	4	0.40%	4	6%
Lithuania	3	0.30%	3	4%
Malta	2	0.20%	2	3%
Subtotal	**899**	**87.20%**		
Associated Candidate States				
Romania	14	1.40%	13	18%
Turkey	7	0.70%	7	1%
Bulgaria	5	0.50%	5	7%
Croatia	2	0.20%	2	3%
Subtotal	**28**	**2.70%**		
Associated States				
Norway	39	3.80%	36	51%
Switzerland	17	1.70%	16	23%
Israel	13	1.30%	11	15%
Iceland	9	0.90%	9	13%
Subtotal	**78**	**7.60%**		
Third Countries				
Russian Federation	3	0.30%	3	4%
Republic of Montenegro	1	0.10%	1	1%
Bosnia and Herzegovina	1	0.10%	1	1%
FYROM	1	0.10%	1	1%
Republic of Albania	1	0.10%	1	1%
Republic of Serbia	1	0.10%	1	1%
Canada	1	0.10%	1	1%
Subtotal	**9**	**0.90%**		
International Organisations	16	1.60%	13	18%
TOTAL	**1030**	**100%**		

Appendix IV

Figure 1: Members of European University Association (EUA)