

# EU - DRIVERS

USING THE ECONOMIC CRISIS AS AN OPPORTUNITY FOR  
ENGAGING UNIVERSITIES IN REGIONAL DEVELOPMENT

## BACKGROUND REPORT

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**EU-DRIVERS**  
European Drivers for a  
Regional Innovation Platform

## USING THE ECONOMIC CRISIS AS AN OPPORTUNITY FOR ENGAGING UNIVERSITIES IN REGIONAL DEVELOPMENT

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## FOREWORD

Universities and higher education institutions in general play a key role in human capital development and innovation systems in their regions. Higher education institutions are increasingly recognised as being stimulators of the economic and social innovation systems in their region. In addition, there is growing awareness on how universities can contribute to regional innovation through collaboration with business, local and regional governments and other local actors which are closely linked to the concept of the universities' third mission. Universities are increasingly encouraged to fulfil their third mission engagement in the region's innovation system.

At a European level, the Lisbon Strategy for Growth and Jobs, as well as the Modernisation agenda for Universities, has focused attention on the need to strengthen the 'knowledge triangle' of research, innovation and education. The recently announced EU 2020 Strategy by the European Commission highlights regional development and reinforces the focus on the need for innovation: "Knowledge is the engine for sustainable growth. In a fast-changing world, what makes the difference is education and research, innovation and creativity".

As the OECD has pointed out, through their research teaching and community engagement, universities can be key actors fostering and supporting regional innovation<sup>1</sup>. This has led to a greater drive to improve regional cooperation between private sector companies, government and the community in order to enhance the capacities of European universities to fulfil such a role. However successful regional cooperation is reliant on the ability of all three key organisational players (universities, government/public authorities and business) to establish strong and feasible partnerships.

The regional dimension of innovation is crucial to promote long term economic growth and competitiveness.

This annual report is the first of a series of three thematic reports produced by the EU-DRIVERS project on the role of universities in regional innovation and how strong partnerships between universities, government/public authorities and the business sector can contribute to dynamic successful innovation systems. The report contains a presentation of the European innovation policies and national trends which is accompanied by a brief theoretical discussion on triple helix partnerships. The report also includes the analysis of the various triple helix partnerships examples leading to a series of findings and opportunities for successful partnerships at a time of economic crisis.

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<sup>1</sup> OECD (2007) Higher Education and Regions: Globally Competitive and Locally Engaged

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Universities are increasingly recognized as being drivers of the economic and social infrastructure in their region. There is growing awareness on how universities can contribute to regional innovation through collaboration with business, local and regional governments and other local actors. The Lisbon Strategy for Growth and Jobs, as well as the Modernisation agenda for Universities, have focused attention on the need to strengthen the 'knowledge triangle' of research, innovation and education. The recently announced EU 2020 Strategy by the European Commission highlights regional development and reinforces the focus on the need for innovation: "Knowledge is the engine for sustainable growth. In a fast-changing world, what makes the difference is **education and research, innovation and creativity**".

This rationale was at the start of the EU-DRIVERS Project, launched by the European Centre for Strategic Management of Universities (ESMU) and the DEAN network in 2009. The project is funded by the European Commission as a three-year (2009-2012) Structural Network project under the Lifelong Learning Programme. Its aims are:

- To create a regional innovation virtual community for exchanging good practices among all stakeholders
- To find solutions for improved regional cooperation between universities, private sector companies and regional governments
- To enable the communication and dissemination of reports and recommendations through conferences and establish a close dialogue with EU authorities.

## THE PROJECT PARTNERS ARE:

- ESMU/DEAN (project leader)
- HUMANE (Heads of University Management and Administration Network in Europe)
- EURADA (European Association of Development Agencies)
- AMSE (Association of Medical Schools in Europe)
- EFMD (European Foundation for Management Development)
- SEFI (European Society for Engineering Education)
- AAU (Aalborg University)
- ACUP (Catalan Association of Public Universities)
- BSRUN (Baltic Sea Region University Network)
- DUK (Danube University Krems – University for Continuing Education)

# 1. EUROPEAN INNOVATION POLICIES

This section will present the European innovation policy context through a revision of the milestones of the past ten years in this field. This section will be overviewing the Lisbon European Council meeting's conclusions in 2000, the Europe 2020 strategy launched by the European Commission in March 2010 among other policies and taking into account some contextual aspects such as the financial and economic crisis.

For the last ten years the European authorities are making an increasing effort to raise social awareness of the relevance of innovation and to create the appropriate measures and tools that can accomplish the targets of the policies. The European Commission is formulating and implementing policies and programmes to augment Europe's innovativeness and trying to contribute to greater competitiveness, sustainability and job creation.

Innovation policies are about helping companies and universities to perform better and contributing to wider social objectives such as growth, jobs and sustainability. These policies involve activities that mobilise<sup>2</sup>:

- Resources (financial, human, organisational) through innovation orientated programmes and projects;
- Information (road-mapping, technology diffusion activities, coordination) which is geared towards innovation activities;
- Institutional processes (legal acts, regulatory rules) designed to explicitly influence environment for innovation.

And need:

- A percentage of (national) public funding;
- A continuing basis (usually not a one-off 'event');
- A target group or eligible participants (including enterprises).

During the Lisbon European Council in March 2000, the European Union set itself the strategic objective of "creating by 2010 a competitive economy based on knowledge, capable of sustainable economic growth with more and better jobs and greater social cohesion". In terms of innovation policy, the significant role played by research and development in generating economic growth, employment and social cohesion and the need of a better integrated coordination of research activities was pointed out.

For this reason the decision to take the necessary steps to establish a European Research Area (ERA) were taken with the aim to:

- Develop appropriate mechanisms for networking national and joint research programmes on a voluntary basis around freely chosen objectives, in order to take greater advantage of the concerted resources devoted to R&D in the Member States, and ensure regular reporting to the Council on the progress achieved; to map by 2001 research and development excellence in all Member States in order to foster the dissemination of excellence;
- Improve the environment for private research investment, R&D partnerships and high technology start-ups, by using tax policies, venture capital and EIB support;
- Encourage the development of an open method of coordination for benchmarking national research and development policies and identify, by June 2000, indicators for assessing performance in different fields, in particular with regard to the development of human resources; introduce by June 2001 a European innovation scoreboard;

<sup>2</sup> Source: PRO INNO EUROPE

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- Facilitate the creation by the end of 2001 of a very high-speed transeuropean network for electronic scientific communications, with the support of the European Investment Bank (EIB), linking research institutions and universities, as well as scientific libraries, scientific centres and, progressively, schools;
- Take steps to remove obstacles to the mobility of researchers in Europe by 2002 and to attract and retain high-quality research talent in Europe;
- Ensure that a Community patent is available by the end of 2001, including the utility model, so that Community-wide patent protection in the Union is as simple and inexpensive to obtain and as comprehensive in its scope as the protection granted by key competitors<sup>3</sup>.

In 2006 the European innovation policy context took another step forward with the Innovation Strategy proposed by the Commission of the European Communities, and a set of instruments and tools that have been established since to support innovation and all the stakeholders that are involved in the innovation system.

This strategy was announced in the *Broad-based innovation strategy for the EU*, and points out how to assure the key elements of the renewed Lisbon strategy for growth and jobs accompanying industrial-led and society-driven innovation with competitiveness and public policies.

The strategy sets a roadmap of ten priority actions at national and European levels. The Commission plans particularly to hearten the emergence of “lead markets”, where public authorities promote industry-led innovation by creating the conditions for a successful market uptake of innovative products and services in a focused way in areas such as e-health, internal security, eco-innovation and eco-construction (European Commission, 2006).

In addition to the Broad-based Innovation Strategy, in 2006 a communication from the Commission to the Council and the European Parliament was released on the *Modernisation Agenda for Universities*. It was concluded that since universities are key players in Europe’s future and for the successful transition to a knowledge-based economy and society, they need in-depth restructuring and modernisation if Europe is not to lose out in the global competition in education, research and innovation. Two years later, in December 2008, the European Council called for a European Plan for Innovation. The first step was to assess the achievements made under the Broad based Innovation Strategy (2006) by presenting reviews of the Lead markets Initiative, innovation in services, financing innovation in small and medium enterprises (SMEs) and the effectiveness of innovation support measures, and, furthermore, to propose short-term actions in response to the economic and financial crisis.

According to the document “Reviewing community innovation policy in a changing world” from the Commission of the European Communities (2009), the Commission intended to explore the feasibility of proposing to the Member States before spring 2010 a European Innovation Act encompassing all the conditions for sustainable development and which would form an integral and crucial part of the future European reform agenda.

This drive towards a more coherent innovation strategy took place during the 2009 European Year of Creativity and Innovation (EYCI), which culminated in the publication of a ‘manifesto’ for innovation.

As a result of all the political activity of the last two years in this field, in March 2010 the Europe 2020 strategy<sup>4</sup> for growth and jobs was launched. The reflections on future innovation policies are an integral part of it. Europe 2020 puts forward three mutually reinforcing priorities:

- > Smart growth: developing an economy based on knowledge and innovation.
- > Sustainable growth: promoting a more resource efficient, greener and more competitive economy.
- > Inclusive growth: fostering a high-employment economy delivering social and territorial cohesion.

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<sup>3</sup> Lisbon European Council (2000).

<sup>4</sup> European Commission (2010) “EUROPE 2020 A strategy for smart, sustainable and inclusive growth”



Furthermore, the strategy puts forward seven flagship initiatives to catalyse progress under each priority theme, and according to the OECD Roundtable on Higher Education in Regional and City Development, three of them are especially relevant in the field of education and training:

- > "Innovation Union" to improve framework conditions and access to finance for research and innovation so as to ensure that innovative ideas can be turned into products and services that create growth and jobs.
- > "Youth on the move" to enhance the performance of education systems and to facilitate the entry of young people to the labour market.
- > "An agenda for new skills and jobs" to modernise labour markets and empower people by developing their skills throughout the lifecycle with a view to increase labour participation and better match labour supply and demand, including labour mobility.

Within the five EU headline targets pointed out in the Europe 2020 strategy, three of them are directly related to the universities:

- > 75% of the population aged 20-64 should be employed.
- > 3% of the EU's GDP should be invested in R&D.
- > The share of early school leavers should be under 10% and at least 40% of the younger generation should have a tertiary degree.

Once a review over the European Innovation Policies across the last ten years has been made, a description of how European organisations have been (and are) fostering the implementation of such policies and measuring their impact through a set of mechanisms and supportive tools and services will be presented.

In this sense, the European Commission provides support for innovation by a series of initiatives and actions (see table 1). Some of them have been designed in order to give financial support for innovators. Others are innovation support services for SMEs, especially start-ups, which develop and test new forms of business support and make possible transnational collaboration with a view to organise more resources for the creation of a European Innovation Space. In addition, there are some initiatives and networks with the target of fostering interaction and cooperation among innovation players.

**Table 1** Initiatives and actions to support innovation

<p><b>Financial support for innovators:</b></p> <ul style="list-style-type: none"> <li>- Competitiveness and Innovation Framework Programme (CIP)</li> <li>- 7th Framework Programme for Research and Technological Development (FP7)</li> <li>- European Structural Funds' Operational Programmes</li> </ul>
<p><b>Support services available for innovators:</b></p> <ul style="list-style-type: none"> <li>- IPR Helpdesk</li> <li>- Business Innovation Centres (BIC)</li> <li>- China SME IPR Helpdesk</li> <li>- Business Plan development tool</li> <li>- Innovation Management self-assessment tool</li> <li>- European e-Business Support Network (eBSN)</li> </ul>
<p><b>Initiatives and networks to foster interaction and cooperation among innovation players:</b></p> <ul style="list-style-type: none"> <li>- European Cluster Observatory</li> <li>- European Cluster Alliance, ProTon.</li> <li>- Regions of Knowledge</li> <li>- Living Labs</li> <li>- European Institute of Innovation and Technology (EIT)</li> </ul>
<p><b>Other initiatives and networks from the EU to support innovation:</b></p> <ul style="list-style-type: none"> <li>- PRO INNO Europe ®</li> <li>- Enterprise Europe Network</li> <li>- Europe INNOVA</li> </ul>

Source: J. M. Vilalta et al.

Additionally, the European Commission has created a set of tools that aim to assure that implemented innovation policies come out with tangible and substantial results by collecting data on innovation performance in Europe. These analyses give insight into the strengths and weaknesses of national innovation systems in EU member states and other countries. They also help in understanding specific drivers and barriers to innovation at a sector level. The data includes assessments of innovation performance, policy responses, innovation policy governance and innovation policy trends across Europe.

One of these instruments developed by the European commission is the INNO-Policy Trend Chart, which measures and analyses independently national and regional policy trends with the target of providing advice to policy assessment and pointing out examples of good practice, trying to improve the source of decision-making in innovation policy.

Another useful tool is the European Innovation Scoreboard (EIS), that provides an annual benchmarking of national and international innovation performance levels across the European Union and internationally. The analysis is made using a set of indicators that cover the different aspects of innovation performance. The EIS was developed on the initiative of the Commission in the framework of the Lisbon strategy for economic growth and job creation.

## 1.1 NATIONAL AND REGIONAL INNOVATION POLICIES

Economic globalisation and world competitiveness has forced governments to find new strategies to become more 'innovative' in economic as well as in political terms. Aiming to describe what kind of policies are being carried out both at national and regional level across Europe, this section will review several cases, obtaining a broad vision of the global situation. The main sources of information have been the numerous reports by PRO INNO EUROPE and those obtained from the OECD Science and Innovation section.

Based on a statistical cluster analysis using different indicators and scores over a five-year period, the European Innovation Scoreboard (2009) classifies countries in four groups according to their innovation performance (see table 2):

**Table 2** Classification of countries according to their innovation performance.

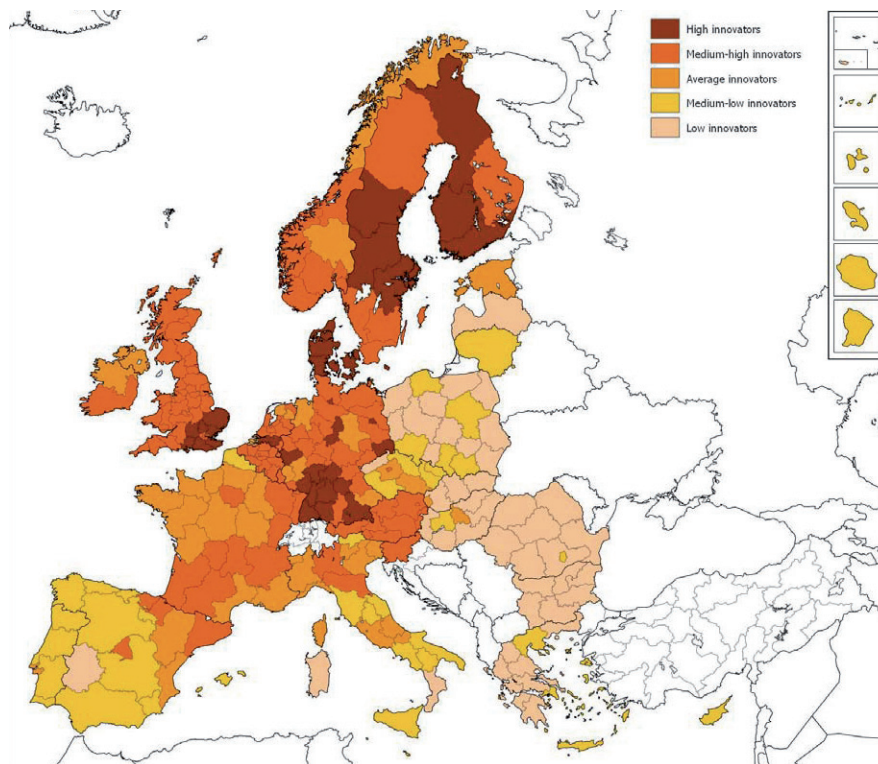
Group	Countries
Leaders	Denmark, Finland, Germany, Sweden, Switzerland and the UK
Followers	Austria, Belgium, Cyprus, Estonia, France, Iceland, Ireland, Luxembourg, the Netherlands and Slovenia
Moderate	Czech Republic, Greece, Hungary, Italy, Lithuania, Malta, Norway, Poland, Portugal, Slovakia and Spain
Catching-up countries	Bulgaria, Croatia, Latvia, Romania, Serbia and Turkey

Source: Adapted from EIS (2009).

The trend of the groups is to converge, since the moderate and the catching-up countries grow at a faster rate than the leaders and followers. However, the economic crisis may hold back the growth, especially for the last two groups, inhibiting the mentioned convergence in the short term. The indicators cannot reveal yet the full impact of the crisis, since they have a time lag of one year at least.

Additionally, regions can also be classified according to their innovation performance. This is the case of the Regional Innovation Scoreboard report published annually, which is based on the analysis of the Nomenclature of Territorial Units for Statistics (NUTS), where five levels of innovators have been identified: High Innovators, Medium-high Innovators, Average Innovators, Medium-low Innovators, and Low Innovators.

Figure 1 European Regional Innovation performance groups



Source: EIS (2009).

Focusing more closely on the member states of the EU, there is a strong diversity in regional innovation performance across Europe; all major EU27 countries have diverse levels of performance and relative strengths within their regions, and Spain, Italy and the Czech Republic are the most heterogeneous. This emphasizes the need for policies to reflect regional contexts and for better data to assess regional innovation performances. The most innovative regions are typically in the most innovative countries. However, the results also show regions that outperform their country level, for instance, Noord-Brabant in the Netherlands is a highly innovative region located in an “innovation follower” country; the Basque Country, Navarra, Madrid and Catalonia in Spain, are all medium-high innovating regions from a moderate innovator.

In terms of taking strategic policy initiatives to support innovation in the crisis, there are four general patterns in which countries can be classified according to the European Innovation Progress Report (2009), which considers both the scope and timing of the interventions. In table 3 it is possible to see how European countries can be classified according to this criteria.

**Table 3** Classification of countries according to their innovation policies facing the crisis

Innovation policies	Description	Countries
Proactive and forward-looking	A policy response dealing not only with the present but also potential or future challenges to innovation-led recovery, across several domains.	Finland, Germany, Luxemburg, the Netherlands, Norway, Switzerland.
Adequate and timely	A timely intervention but with a stronger focus on general economic support.	Belgium, Cyprus, the Czech Republic, Denmark, France, Ireland, Italy, Luxemburg, Malta, Poland, Spain, Sweden, the UK.

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Defensive	Quite delayed response, mostly focused on general economic support measures but with a few additional innovation-specific initiatives or reinforcement of pre-existing measures.	Austria, Bulgaria, Croatia, Estonia, Greece, Hungary, Portugal, Slovakia, Turkey.
Inadequate	Delayed, defensive, focused only on general economic support measures, no innovation-specific initiatives.	Iceland, Latvia, Lithuania, Romania, Slovenia.

Source: European Innovation Progress Report (2009).

In order to get some insights about the specific policies or actions being carried out by some of the countries listed above, a few country cases are presented below capturing their experience and exemplifying how the economic crisis has been embraced:

- The Finnish government can be mentioned as a promoter of a proactive and forward-looking innovative policy which consisted on a complete stimulus package agreed in January 2009 concerning education, research and (job-related) training. Moreover, it included a renewed strategy of the one elaborated in 2007-08 assigned to the evaluation of the national innovation system in order to identify the current and future challenges.
- Similarly, the Swiss government has implemented preventive measures, by including additional expenditures on research and innovation activities, mainly focused on sustaining the R&D and innovation capacity of Swiss enterprises.
- Norway's government launched a set of stimulation activities in 2009, in order to enhance innovation support in trade and industry.
- Another Nordic case is Sweden, where only a few immediate innovation policy initiatives have been established: a new state-owned risk capital company focused on the motor vehicle industry and a new law on research providing resources for commercialisation of university research (2008).
- The Czech government created the ad hoc National Economic Council in January 2009 to analyse the risks and potential impacts of the global financial crisis and to propose measures to reduce impacts of the crisis. The set of proposed measures included a clear commitment not to reduce public investments in R&D and Innovation. The National Economic Council created in January 2009 by the Czech government analyses the risks and potential impacts of the global financial crisis and proposes measures to reduce the impact of the crisis.
- In France, the government designed a Recovery Plan in 2009 which includes the creation of a special ministry with additional investments to be channelled in key areas (such as higher education and research).
- The Italian government has not cut public R&D expenditure nor business support. Moreover, additional support is available for research centres and universities.
- The Portuguese innovation policy strategy (approved in 2008) includes the reinforcement of public investment, modernisation of schools and technological infrastructures, support to the economy, incentives for SMEs or employment facilities.
- In Hungary, innovation policies mainly have been focused on defensive actions like cost-cutting, short-term job protection and retaining foreign investors' confidence.

Comparing the results observed in both performance and policy trends analyses, there are some deductions that have been obtained. The countries that have acted in a proactive or timely manner are, in general, innovation leaders, while the ones that have been likely to adopt a defensive approach or failed to take adequate action are moderate innovators and catching up countries. It would be premature to try to conclude the effect that the introduced policy measures have had in each of the described cases. Nevertheless, it is obvious that the complete recovery will not be possible without a comprehensive commitment by the governments to identify and put into practice the most suitable policy measures in each case.

## 1.2 INNOVATION POLICIES IN CATALONIA

Catalonia has 7.5 million inhabitants, a strong distinct national and cultural identity and a language of its own. It is a very entrepreneurial society with a GDP that accounts for almost 20% of the Spanish GDP. The industrial tradition has led to a diversified industrial base, concentrated in medium-low and medium-high technology sectors. Thus, innovation is crucial to ensure sustained economic growth, especially for its SMEs. Catalonia contributes significantly to Spain's innovation system due to its size and strength. Catalonia, together with Madrid and Andalusia, contribute to more than half of the Spanish GDP.

Catalonia has a long tradition of active regional government policies to promote its innovation system, even before Spain's integration in the European Union in 1986. The innovation policy approach has been influenced by many factors such as the European Union policies, the devolution of competences from the national government to the regions, the political and governance context within Catalonia itself and an increasing recognition of the impacts of research and innovation for the economic development, competitiveness and well-being.

Catalonia's science and innovation policy over the last two decades has been focused mainly on improving public research (part of the knowledge generation sub-system). The strategy has followed an academic path given the dominance of academic and research institutions in the policies and funding. Over time, the region has had successive research plans that have focused on providing funding for universities and research centres to incentivise research and innovation. The first plans focused on research only (1993-96, 1997-2000). From 2001-04, both research and innovation plans were developed. The 2005-08 Plan was the first to include and combine science, technology and innovation support in one plan and integrate both supply and demand side policies. The new 2010-13 Plan has followed the same strategy.

The Catalan innovation system has a wide range of innovation actors, many of them created in the last few years. The Catalan government has provided the necessary support for the creation of most of these organisations, in some cases to get round rigidities in the current higher education system. Other entities have been created with a variety of external financing resources. The multi-level governance framework, with Spanish, Catalan and local actors, as well as the European Union, is another factor that contributes to the wide range of actors related to innovation. Catalan policy for research and innovation has developed with a goal to maximise resources from Spanish and European levels through the competitiveness of its research assets. Although to a large extent the strategy has focused on research centres outside of universities, the approach in Catalonia has also benefited some universities who have been able to build capacity to apply for such funds. EU research funding sources continue to increase, however, Spanish funding sources, which had grown considerably in the last years, are under pressure due to the economic crisis and the recent funding cuts.

The ministry that administers most of the funding for research and innovation is the Ministry of Innovation, Universities and Enterprise (DIUE). DIUE accounted for more than 68% of R&D and innovation related spending in Catalonia.

Under the ministry level, there are several public entities that play an important implementation role in R&D and innovation. Among them:

- **ACCIÓ**: The result of the merger of the former Centre for Innovation and Business Development (CIDEM) and the Consortium for Commercial Promotion of Catalonia (COPCA) which were created in the 1980s. ACCIÓ is the main agency for supporting business development.
- **Talència**: this organisation has integrated a whole set of funding measures in research and scientific talent attraction in Catalonia. Until now, these measures were shared between the Agency for Management of University and Research Grants (AGAUR), the Catalan Foundation for Research and Innovation (FCRI) and the Catalan Institution for Research and Advanced Studies (ICREA). ICREA focuses exclusively on talent (researcher) attraction and has been a very successful initiative so far.

An interesting experience is the Technological Springboards Network which has promoted the creation of spin-offs from universities. Nearly two hundred new technology-based companies were created between 2006-08, although once created, the spin-offs rarely grow in employee size.

The Catalan government has sponsored the creation of a series of independent research centres in the last several years as a vehicle to strengthen the region's research capabilities. These centres are not controlled by the universities, although they involve one or more Catalan universities as well as other entities. The independence of the centres is reinforced by their own legal status, a private management model with external scientific committees, a talent-based recruitment policy allowing for dynamic human resource policies, and sufficient structural funding and investment in scientific equipment from the regional government. These centres are considered a major contribution to the research and innovation performance in Catalonia.

In 2008 the Catalan Agreement on Research Innovation (CARI) was signed and published. The process to develop this agreement actively involved universities in its development. Universities were therefore signatories to the agreement, along with the three political parties in parliament, trade unions and employer associations. The CARI sets the vision through 2020 of what the region should do through a series of 131 commitments. Many of these commitments explicitly engage universities to work towards the objectives set for addressing each of the eight challenges. This agreement sets a precedent for more active dialogue and clarity with regard to the university role in knowledge production, and increasingly, technology transfer. The process helped to build consensus on a vision. The last research plan, the Catalan Research and Innovation Plan 2010-13, is the instrument to implement the CARI priorities. The CARI indicates an increasing need for all public research actors to be held accountable to higher standards as well as to orient part of their research towards regional needs. The plan also promotes a broader view of innovation - including the role of social sciences and the public sector. It also advocates a greater territorial approach, including seven sub-regions within Catalonia.

Another important actor in the innovation context in Catalonia is the Catalan Association of Public Universities (ACUP). The eight public universities of Catalonia associated as a university cooperation that arises as a response to the massification of higher education in the last two decades and the increasing international competition of the higher education sector. In June 2008, ACUP presented the *White Paper of the University of Catalonia*. This *White Paper* expresses the vision that the Catalan public universities have on their role in and for the Catalan society and is meant to be an objective in itself. The *White Paper* consists of eleven chapters, 64 strategies and 73 projects to achieve the goals outlined. The rationale behind the *White Paper for the University of Catalonia* is, according to ACUP, the call upon universities to play a pivotal strategic role in the changing of society and the knowledge economy through three main channels: university education, scientific research, innovation and social progress, and last but not least, collective welfare and competitiveness (ACUP, 2008). This new model proposes that the university should be research-intensive and stand at the heart of the scientific, technological and cultural system.

While Catalonia is not always the top-performing region in Spain on several innovation-related indicators, given its size it accounts for a large share of Spain's innovation activity and resources (OECD, 2010). Catalonia is responsible for 21% of Spanish research and development (R&D) investment and 33.7% of its patents. Catalonia contains 22.5% of Spain's innovative firms, a far greater share than other regions, the next highest shares being Madrid (15.6%) and Andalusia (15%) (OECD, 2010). The main weaknesses are related to regulatory issues and rigidities with respect to universities and long-term researcher mobility, the fragmentation of public action (within Catalonia and in co-ordination with programmes from other levels of government), and the lack of innovation culture, as manifested in the lower patenting rates and R&D intensity relative to other leading regions. Nevertheless, given its scale and performance, Catalonia is often the largest or second largest recipient region of R&D and innovation-related programmes. Among the region's main strengths are its strong research infrastructure and regional attractiveness.

## 2. THE ROLE OF UNIVERSITIES IN INNOVATION

### 2.1. THEORETICAL FRAMEWORK

Nowadays internationalisation and globalisation can be considered as driving forces for the knowledge society, where new trends on the location of knowledge and the development of technological capabilities are gaining importance, becoming strategic issues in the establishment of innovation policies regarding regional development.

In this sense, higher education institutions play an important role. While for decades universities have been seen as structures for providing trained personnel and generating knowledge, the contemporary university is an amalgam of teaching, research, entrepreneurial and scholastic interests (Etzkowitz et al., 2000) providing qualified graduates and researchers, but also offering innovative solutions through technology-transfer mechanisms which enhance links with the local industry system. As a result, and also as a consequence of the conjectural financial situation, governments are rethinking how to maximise the benefits from higher education in order to use them as principal agents for regional development and assist economic recovery.

But before going on, we should define and understand the theoretical framework that supports innovation systems. The theoretical framework can be found in two main and related nested theories: the "Triple Helix" (Etzkowitz & Leydesdorff, 1997; Leydesdorff & Etzkowitz, 1996) and the "regional innovation systems" (Cooke, 2002; Lundvall, 1992). The "Triple Helix" model connects the traditional categories of the innovation economy with institutional and evolutionary economics, joining the three main institutional sectors (public, private and academic). By this approach reciprocal relations between these three spheres can be seized at different points in the knowledge capitalisation process, however, the main difficulty of the model lies in its high level of abstraction as well as in the sociological relationships that hinder its empirical adaptation. This is the particular point where the "regional innovation systems" theory comes into play, transforming the classical categories of the Triple Helix into measurable elements according to their geographical dimension, emphasizing the concept of "region". This particularisation enables the local perspective needed to perform efficiently (Tödtling & Trippl, 2005).

Traditionally, the classical model for innovation was the one proposed by Schumpeter (1934), where innovation was conceived as a linear process expressed in terms of "market pull" or "market push", but insufficient to induce transfer of knowledge and technology (Etzkowitz & Leydesdorff, 2000). Its modern version appeared fifty years later in a leaflet about user-producer interaction and product innovation (Lundvall, 1985). Later, Freeman's work (1988) and Dosi et al. (1988), Lundvall (1992) and Nelson (1993) contributions transferred the concept to the international audience, beginning to define what would be known as the theory of "national innovation systems", acquiring the essence of the "national systems of political economy" defined by List (1841).

Although there is no single accepted definition for a national system of innovation, according to Freeman (1987) we can say that such a system is a "network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies", representing a scientific and technological advance in four domains: social, political, economic and cultural. From there, different nuances and insights began to appear in the literature trying to define what can be or can not be considered an innovation system.

Recently the interest has focused on "regional innovation systems" (p.e. Autio, 1998; Cooke et al., 2000; Doloreux, 2002), largely due to an international competition driven by a fast and globalized economy, the apparent failure of traditional policies for regional development and the success of industry clusters and dynamic agents throughout the entire world. In fact, the alignment between innovation policies

and the region is essential, as only a local perspective can be aware of the economical and social structure of the region when defining policies that have to boost competitiveness and facilitate knowledge transfer.

But what can be considered as a "region"? The wideness of the term derives into a flexible definition which can be applied to any kind or typology of region (see table 4). There is solely the requirement that the region under study has to have a consolidated productive structure (techno-economic) and an institution one (political-legal), where innovation flows in an interactive, non-linear, reciprocal direction.

**Table 4** Units of analysis found in regional innovation systems studies

Units of analysis	Authors
Cities	Crevoisier & Camagni (2001); Simmie (2001)
Metropolitan areas	Isaksen (2004); Feldman & Audretsch (1999); Brouwer et al. (1999)
Districts inside metropolitan areas/cities	Asheim & Isaksen (2002); Porter (1998); Saxenian (1994)
NUTS II (Eurostat)	Evangelista et al. (2002)
Supra-regional/sub-national scale	Capron (1998); Gertler & Wolfe (1998); Latouche (1998)
Countries	Maskell (1998)

Source: Adapted from Doloreux & Parto (2005) and Rip (2002).

Thus, "regional innovation systems" consist of a set of political, industrial and academic institutions that, by design or unintended consequence, work to improve the local conditions for innovation (Etzkowitz, 2002).

## 2.2. THE ROLE OF UNIVERSITIES IN INNOVATION PROCESSES AND POLICIES

In this framework of regional innovation systems, higher education institutions have been identified as crucial agents for the establishment of regional policies and therefore their importance has clearly grown over time (Mowery & Sampat, 2004).

On one hand, governments and policy makers are increasingly establishing regional policies on knowledge transfer activities from universities and research institutes to the industry, aiming to increase the application of scientific advances (Mowery & Sampat, 2004) and exploiting all the knowledge substrate. On the other hand, simultaneously, academics are focusing their interest in new theories and models such as the "innovation systems" (Freeman, 1987), the "new regionalism" (Cooke, 1998, 2002a; Florida, 1995), the "Mode 2" (Gibbons et al., 1994), the "commitment theory" applied at universities (Holland, 2001; Chatterton & Goddard, 2000) and above all the "Triple Helix" model (Etzkowitz & Leydesdorff, 1997), all them focused in how to explain the role played by universities and how to illustrate the existing interactions that take place inside innovation ecosystems.

As aforementioned, different attempts have been made in order to characterize the role of universities in innovation processes and policies, however there is no one single accepted model capable to encompass the multiple agents involved neither their interests or relationships. Nevertheless, different approaches can be considered after analysing the theories and policies depicted above. While one perspective tries to explain the universities' role through the evolution of their mission and orientation over time, the other one conceptualises universities as a cyclical process where they can act as consumers, suppliers and employers, becoming strategic organisations with a high impact on regional economy.



## 2.2.1 UNIVERSITIES' MISSIONS PERSPECTIVE

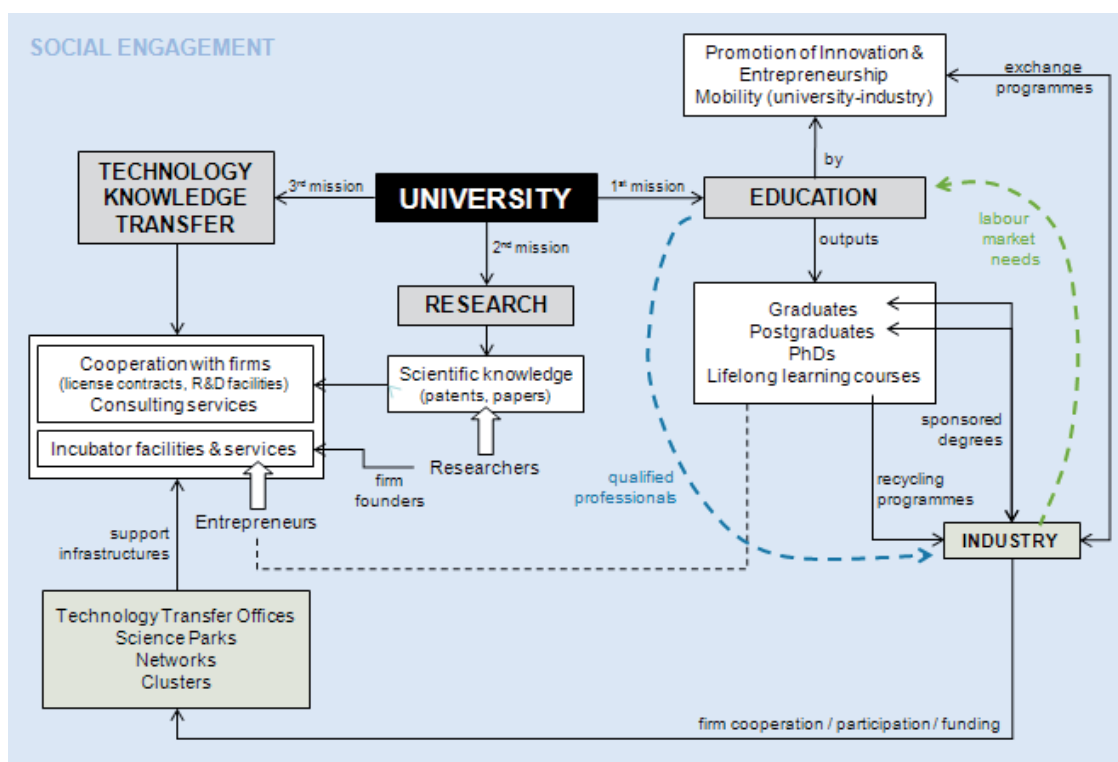
Universities' non-linear movement from a teaching and research format to an entrepreneurial one has been and is being studied all over the world in different academic systems such as the United States, Europe, Asia or Latin America. Notwithstanding, the European case has generated a worldwide debate, especially as a consequence of the Bologna process and the convergence to a European Higher Education Area (EHEA). Specifically, according to the Lisbon Strategy (2000), Europe aims to become "the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion". Thus, willing to achieve these goals to promote regional development, European universities have been undergoing substantial transformations at a structural, normative and cultural level, trying to adopt an entrepreneurial spirit which should be reflected somehow in their vision and strategy, that is, through their mission.

In its origins, the specific mission of universities consisted in the creation and transmission of knowledge, to expand and spreading the scientific stock by carrying out teaching and research activities. Resulting from social and economic changes, but also as a consequence of a massive incorporation of students, universities evolved from a vertical conception to an open matrix one. At that point, research activities expanded and new figures appeared professionalising different tasks related with research activities. Universities evolved from teaching institutions into ones where teaching and research develop simultaneously, a trend that is still ongoing today in many countries. Although tensions coexist between them, the combination of both is both more productive and cost-effective.

The entrepreneurial university followed the matrix model, where the research function was organised into different units, the valorisation was generalised and advanced services were created in order to support research activities (Solé-Parellada et al., 2001). This approach assumes that the market is a driving force that encourages external collaboration with industry, strengthening academic performance and attracting additional non-public funding and resources. That is, universities are entrepreneurial when they are not afraid to maximise the potential for commercialisation of their ideas and create value in society, having this no damaging effect in traditional academic values (Clark, 1998). It is in this scenario where the so-called "third mission" appears, resulting from the combination of the two previous and as the achievement of the second, with a remit for economic and social development, yielding in production (research), transmission (teaching and publication) and putting knowledge into use (usage of innovative solutions to solve regional problems by strengthening the linkages with the firms). From above, it is clear that universities are powerful drivers of innovation and change in science and technology but also in society. However, the role of universities cannot be fully understood without an individual analysis of their specific missions in order to be able to draw in which way each one of them contributes to innovation development (figure 2 on page 18).

Regarding the contribution that higher education institutions can make to society through "education" or their first mission, the main results can be measured by the outputs obtained, namely, the number of graduates, postgraduates and PhDs. Universities recognize that during economic downturns, many people turn to education as a way of becoming more competent and best placed to find employment. Although the majority of educational courses and curricula in most European countries are still dictated by regulations and ministerial orders with little freedom of action for universities, there is a growing and emerging trend (promoted by the European Higher Education Area) that takes into consideration labour market needs when designing academic degrees. The aim of this strategy is clear, on one hand to generate a top-level workforce with the right profile and skills according to labour market demands in order to help graduates and postgraduates to find employment easily, and on the other hand to match university training with employers' needs. But to fulfil this target and materialise these expectations in curriculum degrees, a close university-industry collaboration is needed.

Figure 2 University missions



Source: J. M. Vilalta et al.

Some forms of cooperation can be achieved by carrying on sponsored degrees. Also internships and stages as well as international mobility are other common actions. But above all, an entrepreneurial and an innovative culture is the core of the education system of the future. Students must have the potential to provide new ideas. To this end, they must be trained and encouraged to become entrepreneurs and inspired to take up new roles to start new businesses.

Universities are also extending their teaching capabilities from educating individuals to shaping firms' demands, exploring new teaching formats. This is embodied in lifelong learning courses offered for specific demands of particular firms (retraining programmes) or in university extension courses, primarily addressed to unemployed graduates, attempting to facilitate their reintegration into the work force, or even to current workers that need to improve competences, skills or upgrade knowledge. Furthermore, new technologies are gaining importance in education, defining hybrid ways of teaching such as blended courses, part-time modules (that can be undertaken when working) or distance learning programmes looking to offer bespoke training which fits companies and learners' needs.

Assessing the second mission, we now consider universities as knowledge producers. Here we can mention the scientific output resulting from research groups, departments, centres or institutes. In this group we might include scientific publications, patents and the intangible know-how. However, if this knowledge is not used and remains in the drawer, it results completely useless. Thus both universities and firms are called to find common interests for the establishment of alliances and cooperation forms in order to benefit from the scientific knowledge stock.

Moving from the second to the third mission, contributions of universities to regional innovation system through research and technology transfer activities are countless. Emerging from the confluence of three main axes (entrepreneurship, innovation and social commitment), this mission allows universities to actively promote the transformation of knowledge into social and economic outputs.



# ANNEX I



Type	Country	Initiative	Impact area	Detailed area	Promoter
Pilot project EU-DRIVERS	Belgium	C-Mine	Local - Region	City of Genk / Region of Limburg	Public Authority (local)
Pilot project EU-DRIVERS	Denmark	BrainsBusiness ICT North Denmark	Local - Region	North Denmark - Aalborg	Public Authority / Business (regional and local)
Pilot project EU-DRIVERS	Finland	Turku Bioimaging	Region	South West Finland	Higher Education Institution
Pilot project EU-DRIVERS	Greece	Novell Environmental Whey at Thessaly, Greece	Region	Region of Thessaly	Higher Education Institution
Pilot project EU-DRIVERS	Ireland	The Creative Dublin Alliance	Local	Dublin City	Public Authority (local)
Pilot project EU-DRIVERS	Spain	Malaga Knowledge Innovation Community	Local	Malaga City	Public Authority (local)
Pilot project EU-DRIVERS	Turkey	INOVIZ platform	Region	Aegean Region	Higher Education Institution
Pilot project EU-DRIVERS	UK	Leadership Academy	Region	South East England	Higher Education Institution
International	Finland	OSKE - Centres of Expertise Programme	Region / Nation	Finland and its regions	Public Authority (regional and national)
International	France	Les pôles de compétitivité	Region / Nation	France and its regions	Public Authority (regional and national)
International	Germany	Excellence initiative	Region / Nation	Germany	Public Authority (national)
International	The Netherlands	High Tech Campus	Local	City of Eindhoven	Business
International	UK	Impact of Higher Education Institutions on Regional Economies (IMPACT-HEI)	Region	Scotland and Northern Ireland	Higher Education Institution
International	UK	Tripartite Advisory Group (TAG)	Region	Scotland	Public Authority (regional)
Catalonia	Spain	22@ - The innovation district	Local	Barcelona (Districts of Poblenou and Sant Martí)	Public Authority (local)
Catalonia	Spain	ACCIÓ - Xarxa de Trampolins Tecnològics (Technological Springboards Network)	Region	Catalonia	Public Authority (regional)
Catalonia	Spain	Catalan Agreement on Research and Innovation (CARI-PNRI)	Region	Catalonia	Public Authority (regional)
Catalonia	Spain	University of Catalonia - Science Parcs	Region	Catalonia	Higher Education Institution

\* Explanations about these codes is provided in table 5 of the report

Year	Agents			Specific practices *
	Higher Education Institution	Public authority	Business	
2008	Limburg Catholic University College (KHLIM)	City of Genk	Innovation Center Limburg	2, 5, 8
2009	Aalborg University	North Denmark Region and Municipality of Aalborg	ICTNORCOM, Business Forum	1, 3, 4, 9
2009	University of Turku and Åbo Akademi University	Centre for Economic Development, Transport and the Environment of Southwest Finland	Turku Science Park	1, 3, 7, 8
2010	Technological Education Institute of Larissa	Region of Thessaly	Co-operation of Dairy Producers of Larissa & Magnisia	3, 6, 7
2008	Dublin Institute of Technology	Economic Development and Planning section of the Dublin City Council	Dublin Chamber of Commerce	1, 2, 5, 7, 8, 9
2010	University of Malaga	Municipality of Malaga	Parque Tecnológico de Andalucía (PTA)	1, 4, 5, 7
2009	Ege University Science and Technology Centre	Izmir Development Agency	Aegean Free Zone	2, 3, 6, 7
2004	University of Surrey	The South East England Development Agency	Regional SMEs	4, 6, 7
1994	Universities of Finland and research centres	Ministry of Employment and the Economy	Enterprises of the region	1, 3, 4
2004	HEIs of France	French Government	Regional and national firms	1, 3
2005	More than 30 universities from Germany	German Council of Science and Humanities	German Research Foundation	2, 3, 7
2003	Eindhoven University of Technology	Dutch Ministry of Economic Affairs, Brainport Foundation, Municipality of Eindhoven, Brabant Development Agency, the Cityregion Eindhoven	Philips, Association Technology Liaison Eindhoven Region	5, 6, 7
2007	University of Strathclyde (coordinator), and Scottish Universities	Economic and Social Research Council, Department for Employment and Learning (Northern Ireland), the Higher Education Funding Council for England, and the Higher Education Funding Council for Wales	Scottish Funding Council	1, 7, 8
2008	Scottish Universities	Scottish Government (Cabinet Secretary for Education and Lifelong Learning)	Scottish Funding Council	1, 4
2000	Universities, research centres, training centres, centres of technology transfer	Barcelona City Council	Enterprises (large, SME, NTBF)	2, 3, 5, 6, 8
2009 (new form)	Catalan universities and research institutes	Department for Innovation, Universities and Enterprise of the Catalan Government	Enterprises of Catalonia (large, SME and NTBF)	1, 4, 6
2008	Universities, research centres, science and technology parks	Catalan Government, political parties in the Catalan parliamentary system, Spanish Government, Local governments	Enterprises (large, SME, NTBF), business associations, trade unions, public collective sector and third sector (NGOs)	2, 7, 8
2008	Catalan Association of Public Universities (ACUP): UAB, UB, UdG, UdL, UPC, UPF, URV, UOC	Catalan Government	Enterprises (large, SME, NTBF)	1, 2, 5

Shaded area: organisation initiating the partnership



At first glance, the universities' motivations to engage with firms mainly deals with the opportunity to access to new sources of funding to develop new activities to which currently they do not have access because of resource scarcity. Moreover, by working hand in hand with industry they can improve the state of the art and get new ideas which can be the basis for new fundamental research. On the other side, we found that the economic downturn is affecting businesses of all sizes, but SMEs make up a significant majority of the industry base in almost all European countries. Focusing on this set of enterprises we can better understand the motivation to establish links with universities as they allow them to broaden their spectrum of expertise, help them to identify and develop technology opportunities being able to afford specific problem solving (often at a pre-competitive stage of product or process development) and give access to a non-ending source of human resources, training and knowledge. It is also a common practice for SMEs with few resources to use universities' research infrastructures as a way to save money and take advantage of the researchers' expertise. This is the case of SMEs with scarce resources that use the universities' laboratories as Research and Development (R&D) labs. Thus, indirectly they are transferring part of their costs to the State which provides a large part of university funding (Slaughter and Leslie, 1997). Other ways of interaction between universities and firms are consulting services, where universities, with a view to attend the new demands of SMEs in the current climate, work directly with small businesses providing additional training and advice in order to find creative responses to real problems.

As argued above, universities can help firms to counteract the negative impacts of the economic slowdown, so it is not surprising that the university sector is also undertaking a wide range of activities in order to help businesses and industry to reach knowledge, expertise and facilities as well as encouraging creativity and innovation. These include, among others, research and development cooperation, consultancy services and innovation networks. By these means, the universities' expertise can be transferred to the industry easily, bringing nearer these two worlds, both physically close and yet so mentally distant.

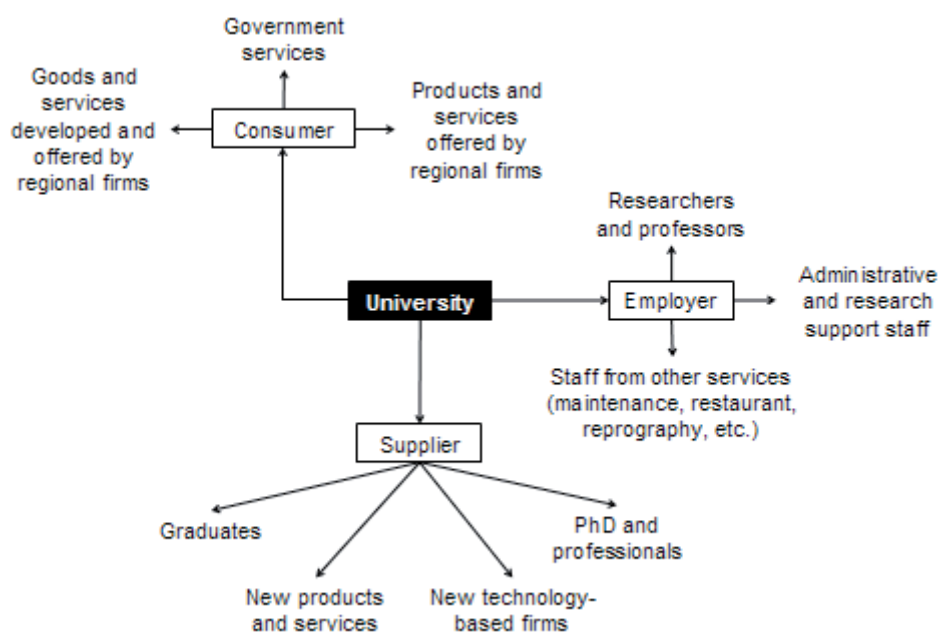
Dual academic careers are also emerging in universities. Beyond the traditional seeking scientist there is the "entrepreneurial scientist" who is able to interface knowledge and innovation (Viale & Etzkowitz, 2005). The scientific knowledge located in a patent form can be the starting point of a business idea, and by extension, the birth of a company. Thus, universities are natural firm founders, and through incubator facilities, provide support structures to initiate new ventures, foster spin-off formation and enhance local gateways to the market.

Finally, universities are engaged with society with the intention of development, individually and as a system by community engagement activities (such as conferences, meetings, exhibitions, open doors days, etc.), added value services and international cooperation and development projects. Likewise, as pointed out before, values are essential in an educational institution. Within a modern society, social commitment and cohesion must be included, guaranteeing access and social inclusion of any person, avoiding any discrimination, as required by any modern civilized society. The final result has a double effect: on one hand the social function of universities gets reinforced as they offer public services that contribute to the welfare of society and culture, and on the other hand, the existing gap between university research and the real needs of society decreases.

## 2.2.2 UNIVERSITIES AS REVOLVING PROCESSES

Universities are an important factor for economic growth, especially for improving development capabilities and regions' economic performance. Indeed, in the evaluation of local and regional economic impact, universities are called to play an outstanding role, considering them as revolving processes (figure 3), where three complementary roles are performed at the same time: consumers of goods (they need resources and services to carry on their activities), employers (they create job opportunities not just for researchers and teachers but also for support staff) and suppliers (offering products, services or creating spin-offs and also providing highly skilled workforce).

**Figure 3** Universities as revolving processes



Source: J. M. Vilalta et al.

As consumers, universities need a set of resources to perform daily activities, claiming for the need to purchase these products or services, which are generally hired to regional suppliers. Acting as regular customers of regional firms, universities contribute to the economic development by creating demand and increasing regions' gross domestic product.

As employers, universities are highly complex institutions that require specialised staff able to carry out all their functions: teaching, research, management tasks, support tasks in departments and research groups (e.g. administrative and service staff, librarians, laboratory personnel) and those services addressed to the whole community (e.g. maintenance, infrastructures, ICT networks, reprographics, catering). From this perspective, universities become institutions that employ a large number of people with different profiles. Moreover, new social demands, new technologies and new innovation processes that must be satisfied almost immediately, result in the creation of new job opportunities.

As suppliers, universities become providers of human capital (graduates, postgraduates and PhDs) trying to satisfy market demands. Likewise, research results turn into new products and services that may even result in the constitution of new companies. Additionally, incubation and advisory services pinpoint universities as seed-beds for new technology based firms and business hubs.

From the above, it can be inferred that the universities' response to the economic downturn is being forceful by linking the local and academic environment. Labour market demands are being considered in education programmes (emphasising on required skills and competences); university research is driven by market and social needs, leading into innovative products and sustainable business; small and medium enterprises are accessing the universities' expertise and know-how, being able to face economic difficulties by turning their weaknesses into their main opportunities; and finally, cultural and social engagement is being achieved by a wide range of added-value activities that promote social progress and collective welfare.



## 3. TRIPLE HELIX: PARTNERSHIPS FOR INNOVATION

### 3.1 TRIPLE HELIX THEORIES

The dynamics of society and the evolution of innovation systems have led into a variety of arrangements between university-industry-government. With the aim of promoting innovation and economical development at a regional level, an international debate about which path should be taken to generate alternative strategies for economic growth and social transformation has been opened. The revision of the existing literature about that topic shows us that better performance rates in regional development can be achieved through the interaction of a variety of institutions and stakeholders, broadly encompassed by a trilateral cooperation between public (government), private (industries) and academic (universities) institutional actors. Known as the Triple Helix model, this new organisational environment tends to integrate the own interests and goals of the different actors (wealth generation for the industry, public control for the government and novelty production for academia) while they work together in issues of regional development.

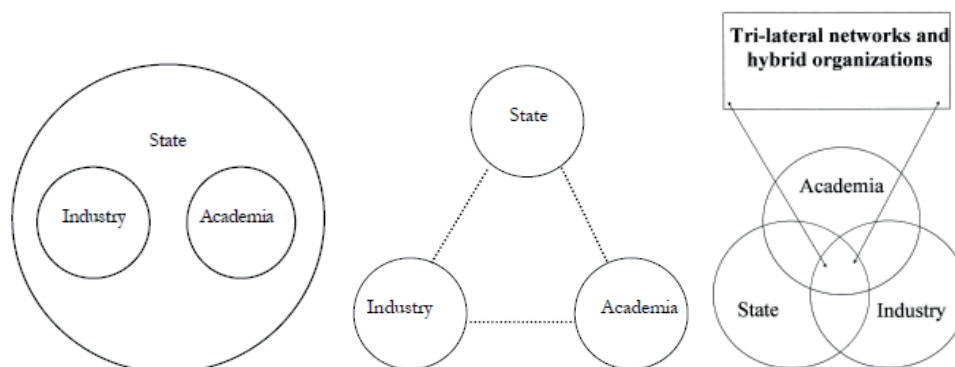
The Triple Helix (TH) model emerged from a workshop on *Evolutionary Economics and Chaos Theory: New Directions in Technology Studies* (Leydesdorff & Van den Besselaar, 1994) organised with the intention of crossing the boundaries between institutional analysis of the knowledge infrastructure and the evolutionary analysis of the knowledge base of an economy (Leydesdorff & Meyer, 2006). Theorised later by Leydesdorff & Etzkowitz (1996) it suggested that in a knowledge-based society the boundaries between public and private sector, science and technology, university and industry were increasingly fading, giving rise to a system of overlapping interactions which did not previously exist (Ughetto, 2007). The main difference between the TH thesis and previous models such as the national systems of innovation approach (Lundvall, 1988, 1992; Nelson, 1993) or the "Triangle" model of Sabato (1975) is that by this thesis universities can be represented with their leading role in innovation, complementing (and not just supporting) the two traditional starting points of science and technology policy (that is government and industry). Furthermore, by using this model, different possible resolutions can be identified (figure 3). In fact, these three spheres, characterized by rigid and strong boundaries in passed decades, are now softening them, configuring a flexible and overlapping system, where each one takes the role of the other. And it is precisely the relative position of the spheres and their potential for movement and reorientation that has generated different configurations.

From a historical situation we can point out the *statist regime*, where the nation state encompasses academia and industry, driving their mutual relations (Etzkowitz & Leydesdorff, 2000). However, this model expressed either in terms of "market pull" or "technology push" was insufficient to induce knowledge and technology transfer because there was too little room for "bottom up" initiatives and innovation. Later, a second model arose, in which the institutional borders of the spheres tightened up, making the establishment of possible relationships more difficult. The main weakness of this model was that it entailed a *laissez-faire* policy, where the industry was the driving force and the other two spheres acted as ancillary support structures. Nevertheless, sometimes it is still used as a way to reduce the role of the State, especially in those countries or regions where it has an excessive control over the remaining spheres. Recently, another configuration has appeared, denoting an overlapping framework in three dimensions that fosters knowledge generation and diffusion by promoting hybrid organisations that emerge from these interferences among the spheres.

In this last case, universities (and other knowledge-producing institutions) acquire prominence, acting in partnership with industry and government and even taking the leadership in joint initiatives in a *balanced model* (Etzkowitz & Ranga, 2010). Simultaneously, the government encourages, but not controls, these relationships through new rules of game (such as new laws and reforms), financial assistance (like a venture capitalist) or via new actors. Finally, industry can benefit from this situation as it is easier

to establish collaborative R&D projects with knowledge-based institutions (having the opportunity to work with scientifics and sharing both know-how) by legal facilities and tax breaks.

**Figure 4** Main configurations of the Triple Helix (TH) approach (“statist regime” on the left, “laissez-faire” in the centre, and “balanced” on the right)



Source: Etzkowitz & Leydesdorff (2000).

So, the TH can be conceived as a spiral pattern of innovation that mirrors the complexity of activities and the multiple reciprocal relationships that take place at different points of the process of knowledge capitalisation in the science/technology vector.

Although the TH has a static characteristic in which the three spheres are independent, there is also an overlapping movement between each of them. Thus, each helix has an internal core and an external field space, drawing two parallel dimensions that expand simultaneously: the vertical one, where each helix develops internally and independently according to its mission or strategy; and the horizontal dimension, where each one forms an interactive circulatory system with the others in terms of exchanges of goods, services, and functions. The result of these interactions provides a knowledge infrastructure that carries the knowledge base.

## 3.2 TRIPLE HELIX INTO PRACTICE

As has been mentioned in the previous sections, government-university-industry interactions are desirable for the economic recovery and development of a territory. However, the mechanisms through which different institutions can contribute to socio-economic development of regions and cities remain quite underexamined. More work is needed on the forms of partnerships that are required to deliver the expected socio-economic benefits across different sectors and in different contexts. To this end, several initiatives around Europe have been examined and included in this report, presenting a set of eighteen selected cases where this partnership has been achieved or is in the process of being established. Thus, the objective of this section is to summarise several European triple helix partnership initiatives in order to highlight practices which offer potential for exchange of experience, and moreover, highlight some common and reiterative trends from this sample.

With this aim, a table has been prepared (see Annex I for a summary of the table) with the most relevant information found in a number of projects. This chart been used as an inventory of the different case features and as a means to identify specific practices and trends. The results and conclusions obtained through the examination of the mentioned cases in the table are limited to the framework of those cases, Therefore, to be able to extend the results a wider study with a bigger and more representative sample of TH cases would be necessary. Although we are aware that these 18 cases are not sufficiently representative of all the trends that are taking place around Europe regarding this topic, they have been selected according to the following criteria:

- 8 Pilot regional innovation partnerships projects (pilot projects, for short), selected by the EU-DRIVERS steering board. Information has also been complemented with data found on their websites and additional reports available through the internet.
- 6 International triple helix initiatives, selected for their impact in the territory and recognition according to the Universitat Politècnica de Barcelona's Science and Technology Park (UPC Park) and the Catalan Association of Public Universities (ACUP) experience. The first selection included a total of twelve international cases, however, after the primary information was collected it was decided to limit the sample according to the amount of information available and the relevance / impact of the cases.
- 4 triple helix projects in Catalonia, selected for proximity and knowledge of the evolution of the cases.

In order to facilitate a better understanding of the cases and to point out their main characteristics a classification of the cases was necessary. After observing the features of the projects, several specific and reiterating practices were identified. These practices refer to the activity that the stakeholders of the partnerships carry out when implementing triple helix partnerships. It is common to combine more than one of these features in a single project as they focus on different specific aspects or strategic actions. Table 5 lists the practices and features found and provides a synthetic definition of what can be understood by each one of them. Although they are all important since they represent different ways to enhance a triple helix relationship, not all of them have the same relevance. Thus, we can find different types of impact in terms of regional development. Practices 1 to 6 have a more direct influence in the development of the territory in a pragmatic way, while the rest (7 to 9) are more related to rising consumers' and society's consciousness about the importance of innovation.

**Table 5** Matrix of specific practices and triple helix promoters

Impact	Code	Specific practices	Description
Pragmatic impact	1	Consensus Spaces	Orchestrated cooperation between actors, and topic exchange programmes.
	2	Innovation and entrepreneurship diagnosis, roadmap and action plan	Design and arrangement of concrete action plans under agreement of several agents in order to foster innovation and entrepreneurship achievements in a certain environment.
	3	Cluster identification, creation and/or promotion strategy	Recognition and classification of different cluster possibilities trying to put together the interests of the potential agents involved.
	4	Agencies/Entities to support innovation and entrepreneurship	Development of agencies that are supposed to give support to the different players of the innovation ecosystem in several fields and with different scopes in each case.
	5	Science Parks / Cities	Provide a certain area with the appropriate spaces and services to favour knowledge transfer, business creation and interaction between all the stakeholders.
	6	Innovation lifts	Business support tools to promote innovation, technology and knowledge in established enterprises.
Consciousness	7	Education engagement	A mission statement from Higher Education Institutions to align their aims with the development of the territory and adaptation of the academic offer to the requirements of the environmental context.
	8	Civil society engagement	Try to make society be part of the process of innovation and aware of the need of a knowledge-based economy.
	9	Network communication	Development of digital platforms like websites or fora to disseminate and provide visibility to the initiatives that are carried out.

Source: J. M. Vilalta et al.

Within the ones related with the pragmatic impact in the regional development we can find the creation of “consensus spaces” which entail organising cooperation agreements between different actors belonging to each of the helixes of the model and putting them together. For example, the initiative *Impact of Higher Education Institutions on Regional Economies (IMPACT-HEI)* in the UK provides an enabling framework for the exchange of knowledge and research findings among holders so that a mutually supportive research community can be created. Another example is the *Malaga Knowledge Innovation Community* in Spain, with the creation of a federation of organisations focused on shared knowledge and inter-organisation teams, fostering the creation of new business opportunities and supporting innovation and entrepreneurship. The *University of Catalonia* is another example of a consensus space, in the sense that it is an integrated system of public universities in Catalonia that promotes synergies and joint projects in education, research, knowledge transfer, quality education and research excellence, with a view to mutual cooperation and collective strategy, shaping a cohesive university system that is territorially balanced and coordinated with a common aim.

Another observed practice consists of the development of “innovation and entrepreneurship diagnosis, roadmaps and action plans” to channel the efforts to foster innovation and entrepreneurship in the same direction and thus, have a more significant impact. For example, the *C-Mine* pilot project of Belgium is a regeneration programme of the city of Genk, transforming and reactivating an abandoned coalmining industry site into a pole of creativity and innovation in the areas of Media Arts & Design. Within the Catalan context, it is worthy to mention the *22@ - The innovation district initiative and the Catalan Agreement on Research and Innovation (CARI-PNRI)*. The first one consists in the creation of a network-like organisation where professionals from different areas work together. It was conceived as a new compact city, where the most innovative companies co-exist with research, training and tech transfer centres, as well as housing facilities and green areas. This city model coexists with the neighbourhood’s industrial heritage. The economic activity of the district is based in five main areas: Media, ICT, MedTech, Energy and Design. The second one is a regional agreement signed in 2008 that defines a shared roadmap between the stakeholders, with the aim of promoting a common agenda for the development of a new socio-economic model based on research, innovation and education, transforming the traditional industrial and service economy to one based on knowledge, guaranteeing high levels of productivity, quality jobs and a cohesive society.

The third practice listed, “cluster identification, creation and/or promotion”, refers to recognition and classification of different cluster possibilities making more feasible to take advantage of the possible synergies resulting from the interaction of different triple helix agents. In the examined cases two examples from Finland have been found, *Turku Bioimaging and OSKE - Centres of Expertise Programmes* which clearly respond to this profile. In the first case, universities create a technology platform, develop research and diagnostic methods and provide research services. Turku University Hospital, local companies / industries, represented by Turku Science Park, as well as national and international companies utilize research platform, results and services, and regional authorities highlight societal viewpoints and demands.

Similarly, in the second example, 21 “Centres of Expertise” are networks operating in various fields belonging to different “Competence Clusters”. Together, they cooperate in developing competencies at the interfaces of research and business activity in an Open Innovation environment. The initiative *Les pôles de compétitivité* in France, is another example that can be used to illustrate this specific practice, in which an attempt is made to strengthen the competitiveness of the French economy and develop both growth and jobs in key markets through increasing innovation, encouraging high-value-added technological and creative activities and by attracting business to France. Another cluster-creating example is the *Excellence Initiative* in Germany, through which more than 40 research schools and 30 Clusters of Excellence have been established and created, and 9 Universities of Excellence have been selected in order to increase Germany’s attraction as a research location in the long term to improve its international competitiveness.

The foundation of “**agencies/entities to support innovation and entrepreneurship**” is another common practice. It consists in developing entities with the aim of providing support to innovation ecosystems’ stakeholders in several fields and with different scope in each case. The *BrainsBusiness ICT North Denmark*, for instance, has founded a secretariat with representatives from each primary partner to attend and manage the daily operation of their ICT cluster. In the UK, with the *Tripartite Advisory Group (TAG)*, universities have an opportunity to influence government on funding issues, have a place for consensus and dialogue through periodic meetings (at least once and normally twice a year) and there are direct relationships between the three partners. In Catalonia, *ACCIÓ* is the agency to support the competitiveness of firms (large and SMEs) in Catalonia, with the aim of improving business in Catalonia and enhancing its competitiveness by encouraging innovation and internationalisation. An example of what has been promoted by this agency is the creation of the “*Xarxa de Trampolins Tecnològics*” (*Technological Springboard Network*), a network of entities that give support to entrepreneurship.

Another practice observed in the cases analyzed is the creation of “**science parks/cities**”, which provide a certain area with the appropriate spaces and services to favour knowledge transfer, business creation and interaction between the stakeholders. According to what has been examined, *High Tech Campus of Eindhoven* (in The Netherlands) is a clear example of this practice. Philips built a Campus in the area where the company was already established to open it to other technological companies, creating a business and science park. At the same time, they started creating their own research centres as well as a technological university in their search for skilled human capital. The *Scientific and Technologic Parks of the public universities in Catalonia* can be mentioned as another example in the sense that public universities have opted to create science and technology parks to promote and foster knowledge transfer to society and the market thanks to regional and state governmental funding.

*Innovation lifts* is another practice listed in the table consisting of providing business support tools to promote innovation, technology and knowledge in established enterprises. The *Leadership Academy* in the UK is an initiative that boosts the skills of business leaders and owners, improving creativity, capacity and capabilities. They deal effectively with issues of risk and trust in terms of encouraging collaboration between the businesses. The initiative targets directly those groups which are significantly affected by the current economic downturn and on whose recovery and growth the success of the regional economy depends. Another example to mention is the *INOVIZ platform* in Turkey, which provides access for SMEs operating in the biomedical sector to the knowledge, skill and expertise of the university.

On the other hand, related to the consciousness about the importance of innovation, the strategies found deal with “Education engagement”, “Civil society engagement”, and “Net Communication”. Concretely, the main goal of this set of practices is to enhance market demand for innovative products and achieve that all actors become involved, not only the enterprises, but future researchers (present students) and consumers (civil society). There should be an innovation friendly market and demand for the outputs, where the consumers and citizens would be ready for new and innovative products and services and could trust in them. It is easier for new innovative products to enter in markets where customer confidence is high.

“Education engagement” consists of a compromise of Higher Education Institutions to align their aims with the development of the territory and adaptation of the academic offer to the requirements of the environmental context. Within the numerous cases found that assume this practice, the case of *Impact of Higher Education Institutions on Regional Economies (IMPACT-HEI)* can be highlighted. It tries to promote better understanding of the key economic and social impacts generated by UK higher education institutions on their host regions and on other regions of the UK, providing an enable framework for the exchange of knowledge, as mentioned beforehand. Another example is the *Novell Environmental Whey at Thessaly*, in Greece, where the university commits to disseminate knowledge on innovative techniques for solving problems of private companies and to enhance university-business collaboration in an area with an extremely low level in this area.

# EU-DRIVERS

In a parallel way, “civil society engagement” is about trying to make society part of the process of innovation and aware of the need of a knowledge-based economy. For instance, *The Creative Dublin Alliance* is a network with a wide variety of partners in order to identify, discuss, recommend, distribute and implement creative and innovative solutions to establish Dublin as an International Competitive City Region. They try to foster communication and engage with citizens through public consultation programmes. Another example is the *Catalan Agreement on Research and Innovation (CARI-PNRI)*, as mentioned beforehand.

Finally, “Network communication” is based on the development of digital platforms such as websites, fora, etc., to disseminate and provide visibility to the initiatives that are carried out. *The Creative Dublin Alliance in Ireland* and the *BrainsBusiness ICT of North Denmark* exemplify this practice.

Following the scope of this section, and in a more in-depth phase of analysis, a double-entry matrix was built, where each of the 18 initiatives studied was assigned to one or several specific practices according to what has been done in the implementation of the triple helix partnership (see table in annex I). The aim of relating specific practices with the 18 observed cases has been useful as it has allowed to understand who has been the main triple helix promoter (public authority, university or business) in each specific practice. Table 6 summarizes this information. An additional column is also provided in order to point out the global number of initiatives that have stressed each practice.

**Table 6** Matrix of specific practices and triple helix promoters

Specific practices	Actors				Global
	Public authority	Higher Education	Business	Public-Private	
Consensus Spaces (1)	6	3	0	1	10
Innovation and entrepreneurship diagnosis, roadmap and action plan (2)	5	2	0	0	7
Cluster identification, creation and/or promotion strategy (3)	4	3	0	1	8
Agencies/entities to support innovation and entrepreneurship (4)	4	1	0	1	6
Science Parks / Cities (5)	4	1	1	0	6
Innovation lifts (6)	2	3	1	0	6
Education engagement (7)	4	5	1	0	10
Civil society engagement (8)	4	2	0	0	6
Net communication (9)	1	0	0	1	2

Source: J. M. Vilalta et al.

From these data and considering that among the 18 projects analysed, 10 have been promoted by public authorities, 6 by universities, 1 by business and 1 by a mixed leadership alliance (public-private), some issues can be stressed:

- Most of the specific practices are boosted by public authorities. Although universities are also trying to lead TH partnerships, they actually prevail in a second position. This might be due to the fact that governments, as normative and regulatory agents (and providers of financial resources), have more power to capture and retain the remaining agents of the innovation systems. An opposite behaviour is the one exhibited by the private sector, with a very limited presence in matters of leadership and with little involvement in initiatives where it participates (except in the *High Tech Campus* initiative, where the firm, in that case, Philips, has been unquestionably the main promoter).

- The most common practices observed are the promotion of “consensus spaces” (mainly promoted by public authorities) and “education engagement” (both by governments and universities) by orienting academic programmes and degrees to market demands and core areas according to territory strengths. Also “cluster creation/promotion” and “science parks/cities” are recurrent practices in which to involve the three spheres of the model. Both practices provide similar results in a territory in the sense that they assume the specialisation in concrete scientific/technical areas, contributing to the generation of job opportunities. Consequently, such practices tend to be integrated into the innovation policies promoted by governments (as it has been seen in the first section).
- It is quite surprising that only a few of the initiatives analysed focus their attention on providing support tools and services on existing business (“innovation lifts”). Perhaps this is because the target audience (mainly SMEs) is already served indirectly through other strategies (i.e. science parks/cities or clusters), not being required to define specific actions aimed exclusively to this group.
- Although in most of the cases they are not mentioned explicitly, “social engagement” practices are largely a key factor for achieving success. If society is not aware of the need to promote innovation and act entrepreneurial, by any kind of effort will be useless.

In the same way, this exercise has been replicated regarding the impact area of the different projects (table 7) obtaining a schematic picture of which kind of implementation is behind each triple helix initiative.

**Table 7** Matrix of specific practices and impact area

Specific practices	Local	Local / Regional	Regional	Regional / National
Consensus Spaces (1)	2	0	6	2
Innovation and entrepreneurship diagnosis, roadmap and action plan (2)	2	1	3	1
Cluster identification, creation and/or promotion strategy (3)	1	0	4	3
Agencies/Entities to support innovation and entrepreneurship (4)	1	0	4	1
Science Parks / Cities (5)	4	1	1	0
Innovation lifts (6)	2	0	4	0
Education engagement (7)	3	0	6	1
Civil society engagement (8)	2	1	3	0
Net communication (9)	1	0	1	0
<b>TOTAL</b>	<b>18</b>	<b>3</b>	<b>32</b>	<b>8</b>

Source: J. M. Vilalta et al.

In order to avoid confusion about what is meant by impact area, it has been necessary to establish a set of definitions. In this way, the term “local” has been used in order to delimitate an initiative that has impacted a whole city (i.e. the *Creative Dublin Alliance* project), a neighbourhood or a specific area of a city (like in the case of the 22@ - *The innovation district* of Barcelona, which is affecting two districts of Barcelona). By “local-regional” it is understood that the initiative has been launched in a city but it has also expanded through the immediately surrounding area or region (i.e. the C-Mine project, which is a local initiative of the city of Genk but also with an impact in the Region of Limburg in Belgium). A “regional” impact area is understood as a county, a province, an autonomous community or any kind of subdivision of a state with similar geographical, functional, social, or cultural features (i.e. *BrainsBusiness ICT* in North Denmark or the *INOVIZ platform* in the Aegean Region). Finally, the “regional-national”

denomination has been used to identify those initiatives at a regional level but with a national impact, or those with a national initiator but which have been developed at a regional level (i.e. *Centres of Expertise* in Finland or the *Excellence initiative* in Germany).

The main trends observed from table (see Annex I) can be in the following directions:

- Most of the initiatives have a regional impact, being more frequent the achievement of “consensus spaces” and “education engagement”. The reason for a major regional impact of such practices and initiatives (see also table 8) might lay in the need of territories to become “stronger” and take advantage of the strengths and opportunities that the region offers (by the existing industry and the allocation of resources), being fundamental to position themselves as leaders in some specific areas of expertise, attracting inversions and generating job opportunities.

**Table 8** Aggregated initiatives according to the impact area

Source	Local	Local/ Regional	Regional	Regional/ National
Pilot	2	1	5	0
International	1	0	2	3
Catalonia	1	0	3	0
<b>TOTAL</b>	<b>4</b>	<b>1</b>	<b>10</b>	<b>3</b>

Source: J. M. Vilalta et al.

- Talking about local initiatives, municipalities’ specific practices are addressed to their citizenship, in order to provide a better quality of life through a wider choice of opportunities (economical, social, cultural, etc.) and attractions (i.e. the *Creative Dublin Alliance*). Their actions also highlight a sense of pride in being from the city, their capital status role (attracting people and business from their county or surrounding region) and the commitment to a common goal, making possible to align citizen services with the promotion of business and economic development (i.e. *High Tech Campus* in Netherlands or the *Malaga Knowledge Innovation Community* in Spain).

In order to have projects with different expertise and level of development, international projects were selected to try to fill this gap. The *Finnish OSKE program*, with more than 15 years of experience is an excellent example. Good practices and excellent results have been obtained at OSKE, reinforcing regions of the country with innovation hubs and clusters. Another case to be mentioned is France’s *Pôles de compétitivité*, where each competitiveness cluster has drawn up a five-year plan, based on a vision shared by the various stakeholders. This five-year term project is divided in two phases. The second one started last year after a positive evaluation of the goals achieved in the first stage.

As a synthesis of this section, it is important to point out that the Triple Helix model provides a theoretical framework in which the three main actors for the economic development of a territory are involved, that is, universities, industry and governments.

The positive synergies derived from the establishment of such partnerships have been discussed and exemplified by using the 18 selected initiatives reported here. As has been observed, the model engages universities as sources of new knowledge and technology, firms become the locus of production, and governments adopt a policy maker role. Any of the agents can be the basis for the development of the others but without cooperation between all of them it will not be possible to achieve regional development successfully.



## 4. DISCUSSION AND CONCLUDING REMARKS

One of the expected outcomes of the EU-DRIVERS project - European Drivers for a Regional Innovation Platform - is to enable the communication and dissemination of reports and recommendations through conferences and establishing a dialogue with EU authorities. Through this first annual report on regional innovation issues, selected triple helix partnership initiatives across Europe have been described in order to provide concrete examples of the knowledge triangle implementation, offering an insight about how the economic crisis can involve an opportunity for new regional developments. In general terms, within this triangle, universities are the knowledge source, industry puts into practice this knowledge through technology transfer mechanisms, and governments provide resources to facilitate the interaction between all the agents of innovation systems and policies.

Over the last ten years several European Innovation Policies have been launched and European countries have designed certain innovation plans to face the economic and financial crisis trying to change their economies to a knowledge-based one. In some cases the results have been more successful than in others. It is too early to conclude the effect of the introduced measures in the recovery of European countries, but it is obvious that it will not be possible without a comprehensive commitment by not only the governments but all the agents implicated to identify and put into practice the most suitable measures in each case.

In fact, the Triple Helix model is increasingly being accepted as a conceptual framework for regional development, as it describes the processes and interactions that result from the cooperation between the university, industry and government spheres. By any means and in one form or another, countries and regions are presently trying to attain some form of Triple Helix partnerships. The common objective is to build an innovative environment by generating alternative strategies for economic growth and social transformation such as university spin-offs, tri-lateral initiatives for knowledge based economic development and strategic alliances among the three spheres.

On the basis of the above analysis we can conclude that the practices that are being used around Europe to enhance regional development through a triple helix partnership have a solid base on innovation processes, products or services. As it has been described, municipalities, regions and nations are undertaking initiatives of different nature to achieve objectives with a similar background. However, the question whether there is a best way to promote it still remains open. Although it has been possible to identify nine specific practices that have been replicated across the 18 initiatives studied, the decision of choosing one or another has to do with the specific reality of each territory. That is, the actors' nature and resource availability is significantly different between regions, so not all regions need the same actions to be carried out and the same actions may lead to different results.

Precisely, from these 18 initiatives (which enabled a more local and accurate approach) and from the specific literature on the area (described in the first sections of this report), it is possible to highlight some first evidences regarding triple helix partnerships in Europe:

1. Triple helix relationships are not expected to be stable. Moreover, the sources of innovation are no longer synchronized a priori and they do not fit together in a pre-given order. Consequently reorganising and harmonising tasks in the intersections must be carried on continuously in order to achieve at least an approximation of the goals. Precisely, it is at the intersection spaces where "innovation in innovation" takes place, as individual and organisational actors "take the role of the others", creating new venues and inventing new organisational formats (Etzkowitz & Ranga, 2010). Here, institutional spheres are more likely to support the emergence of creativity that arises in other spirals, thus, as the TH model is time and environment dependant, it should leave room for uncertainties and chance processes in any of the possible configuration the helices adopt.

2. The triple helix model pursues a close engagement between the actors involved, and its major problem is still laying in how to cope with the challenge of managing multiple partners with differing expectations in a highly complex political environment. It is widely recognised that connections between industry and universities are difficult and in many cases truncated, but the evidence from the eighteen initiatives analysed suggests that it is possible to achieve an alignment of interests among the three spheres. Enterprises, research institutes, universities and other higher education institutions, as well as many national, regional and local governmental and non-governmental organisations have their own expectations; however, a shared culture of networking and trust is the clue in the way to facilitate the formation of common goals especially in a context of economic crisis.
3. We must keep in mind that universities are, by nature, long-term organisations, and their contributions to regional development require both time maturity and implementation. This does not mean that universities are neither adaptable nor flexible. On the contrary, universities have changed their structure substantially in the last fifty years. A quick review of the governance regulation of these institutions across Europe could corroborate this statement. In fact, university missions and structures have been redefined in an attempt to fulfil labour market demands. Universities are assuming alternative internal structures in order to overcome society's demands. Following Clark's (1998) dissertation, the adoption of entrepreneurial mindsets, with more flexible and cross-horizontal structures, is seen as a good practice in order to enhance the interconnectivity of their units making possible to expand the services offered and to strengthen ties with the innovation system.
4. Regarding exclusively the university sphere, the so-called "third mission" is increasing its impact on the traditional functions (education and research) of these institutions, playing a crucial role hitherto unexplored.
5. The alignment between industry and universities' interests is still under construction, where issues regarding tradition and culture are recurrent sources of confrontation. Additionally, measures of success vary depending on the perspective taken, especially as incentives for researchers who contribute to regional needs are not fully taken into account in promotion and accreditation processes. Firms are more likely to enrol collaborative initiatives from which they can acquire academic expertise (that is, to absorb, apply and diffuse the knowledge resulting from research activities), with few firms evaluating the outcomes of interactions in financial terms. On the academic side, however, success might be measured by the scientific outputs generated (publications, patents, amendments in teaching programmes, etc.) that can be used in the researcher's curriculum in his or her attempt to achieve promotion, and by the extra income associated with the collaborative project.
6. World economies have traditionally been run by industry. Thus, if firms are driving forces of the economic growth of regions, it is expected that they should perform an active role in triple helix partnerships. However, on the basis of the 18 selected initiatives, firms have an insufficient involvement in the initiatives and a limited presence as promoter agents of such relationships. Maybe this could be in line with what has been found in a recent study carried out by the Centre for Business Research of the University of Cambridge (Connell & Probert, 2010). Although agreements between universities and firms are being signed, firms are seriously critical about universities' tendency to overstate the market readiness, and hence the value of its Intellectual Property and the slow pace of collaborative work. Following with this report, it is pointed out that practices that have improved industry linkages deal with solving customer problems and paid R&D contracts, betting for the establishment of Intermediate Research Institutes, as non-academic research organisations with a mission to develop technology for commercial application, but with substantial core funding enabling investment in long-term programmes and/or R&D to support government objectives.
7. According to the observed initiatives, the role developed by public authorities exhibits a controversial duality, acting both as a normative body (by laws about educational degrees, regulating plans for technology transfer activities or decrees about intellectual property rights) but also as a

promoter (through support programs for firms, especially SMEs, facilitating R&D activities that can add value and create jobs in the region). Although these two roles can be easily implemented individually, the difficulty lies in having to execute them simultaneously and finding an adequate commitment between them.

8. Governments exhibit different assumptions and policies in relation to suitable scales of engagement (from local, to regional or national). There is a need for an effective strategic fit in policy making, being necessary to examine national needs in relation to regional and local priorities.
9. A balance should be found between national coordination and regional diversity. Each region responds to a specific reality and it is not possible to have world-class centres of excellence in each region. Specialisation of the territory should be achieved in a proper proportion to the potential of each region. Furthermore, it is even more difficult when territorial distribution of universities does not match the needs of the companies.
10. Natural territory barriers are also making economic growth in regions more difficult. While metropolitan areas face the challenge of having a highly fragmented economic activity, in old industrial regions reminiscences of earlier activities hinder the development of new occupations, and in peripheral regions the institutional thinness (small amount of key actors) hampers innovation activities (Tödtling & Trippl, 2005).

Taking the above ten points resulting from the background and experience acquired in the revision of both the literature and the case studies, some policy lessons could be drawn, providing a set of recommendations, actions or opportunities of which to take advantage in order to encourage successful triple helix relationships. With this, it is not intended to downplay importance to any other topic not mentioned here, but to point out some opportunities for successful partnerships:

- Acknowledging the variety of actors that conform regional innovation systems, and being aware that each one has different expectations and perceptions (although they pursue common goals), it is absolutely necessary to define appropriate metrics and to revise the existing methodologies and models to assess the economic impact of the initiatives undertaken. A standardized approach is needed in order to provide data for subsequent treatment.
- Such a close linkage between policy makers needs a more in-depth evaluation system, in order to understand and seize the capacity of the institutions involved, the quality of the outputs provided and obtained by each of the partners and the impact of the global initiative undertaken or the policy dictated. This means that evidences have to be collected periodically, in a multiple-stage process, and not just at the end.
- Sometimes governments show sceptical attitudes on whether regional investment in science is the best way to spend scarce resources for economic development. Governments should be sensitive to regional and sub-regional contexts in policy formulation, being based on recognition of distinctiveness and promoting joint policies between science and innovation, universities and regional policy.
- Policies should be focused on network development, bridging the existing communication gap between the spheres of the triple helix model. It is broadly known that each helix has its own code and discourses might be different. Although tensions and conflicts of interest are unavoidable, this model can not work without an agreement of the three parts, so convergence is needed in order to find a shared alignment as a driving force for interactions. Also, communication within and between government departments concerning R&D policies and higher education should be improved substantially, as policy making is often characterised by misalignments, duplications or overlaps. Likewise, within regions, communication might be used as a way to engage not only the actor but the society, ultimate target of the policies defined.

- Further work is therefore required to raise awareness on about the importance of universities and its integration into innovation processes, becoming indispensable to implement their capacities in the surrounding region as a way to enhance regional development and as a means to recover from the prevailing economic recession climate. In this sense, there is a general consensus that training, innovation and technology transfer are key factors to overcome the current economic downturn. However, to fulfil this aim there are still several challenges that should be addressed in areas such as governance, human resources policy, internationalisation and funding. Furthermore, universities should send clear messages and information on the research results that are being brought into society in order to solve real problems. This will enable a better integration between the three spheres of the triple helix model.
- Promotion of Innovation Ecosystems that progressively increase their complexity, following the example of Boston and Cambridge (Massachusetts) or the Silicon Valley (California) by replicating similar conditions in Europe. That is, improve regional conditions for innovation by concentrating related R&D activities.
- Creation and development of "Consensus Spaces". That is, physical spaces, convening platforms or virtual frameworks that bring together the Triple Helix actors to brainstorm, discuss and evaluate proposals for advancement towards a knowledge-based regime in a neutral ground where actors from different organisational backgrounds and perspectives (such as isolated entities, firms, academic institutions and government bodies) work as part of a large whole (Etzkowitz & Ranga, 2010).

According to what has been observed, the concluding remarks have to draw attention to the fact that, currently, benefits arising from triple helix relationships are far from their true potential. We have the required capabilities and the sufficient resources to meet the challenges that modern society yearns for, however we do not manage them in an appropriate way. Triple helix models help us to define how, through university-industry-government interactions, regions can develop economically, especially in periods of economic difficulties, but at pointed above some adjustments and reshaping are needed both inside and along the three spheres. This is consistent with what was pointed by Martin & Irvine (1989) more than 20 years ago, that five premises should be taken into account in order to achieve successful partnerships: communication (bring together disparate groups in an arena to discuss and interact), concentration on the long term (think forward), coordination (through networks and partnerships), consensus (attainment of a common vision) and commitment (desire to implement the common vision in the light of a common output).

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