

ACADEMIC ENTREPRENEURSHIP
PROMOTION AND SUPPORT ACTIVITIES

THE PORTUGUESE EXPERIENCE

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Abstract

Entrepreneurship has been gaining a growing interest in all societies. With the new economic context, the small and innovative, fast growing firms are seen as the base of future economic growth. Individuals are expected to acquire the capacities to evolve in this new society, and therefore educational institutions have been suffering a growing pressure by governments and stakeholders, to raise entrepreneurial citizens. Universities in particular are in a prominent position, because of their core missions of teaching and researching. They can educate citizens for entrepreneurship, and they can exploit their research results and transfer them to the market, creating firms or collaborating with existing ones, which will contribute to innovation and lasting economic growth. Universities have to embrace a new mission, committing themselves to act in benefit of societal development. Academic entrepreneurship is the universities third mission's achievement.

In this study, we have analyzed the situation of Portuguese universities in embracing entrepreneurship, promoting it within their community, fostering and supporting its development. 14 Portuguese public universities were studied, according to their organization, entrepreneurship support structures, and educational curricula. If it became evident that all universities were implementing entrepreneurship in their curricula, it was also clear that it is still very limited, and entrepreneurship is far from being taught to every student. Regarding knowledge and technology transfer support, there again all universities are participating, but despite some good examples of multiple support structures, in some universities there is still a lack of investment, preventing entrepreneurship full dissemination and valorization.

Keywords: Entrepreneurship, Universities, Education, Knowledge and Technology Transfer

Resumo

O empreendedorismo tem vindo a ganhar um crescente interesse em todas as sociedades. Com o novo contexto económico, as empresas pequenas e inovadoras, são vistas como a base do futuro crescimento económico. Espera-se que os indivíduos adquiram as capacidades para evoluírem nesta nova sociedade e que as instituições educativas ajudem a criar cidadãos empreendedores. As universidades, em particular, estão numa posição proeminente, devido às suas missões fundamentais, o ensino e a investigação. Consequentemente, podem educar cidadãos para o empreendedorismo e explorar os resultados da sua investigação transferindo-os para o mercado, criando empresas ou colaborando com as existentes, contribuindo para a inovação e o crescimento económico. As universidades devem aderir a uma nova missão comprometendo-se com o desenvolvimento da sociedade. O empreendedorismo académico constitui-se como a concretização da terceira missão universitária.

Analisámos a situação das universidades portuguesas ao aderirem ao empreendedorismo, encorajando e apoiando o seu desenvolvimento. Foram estudadas catorze universidades públicas portuguesas, em relação à sua organização, estruturas de apoio ao empreendedorismo e currículos educativos. Se, se tornou evidente que todas as universidades estavam a implementar o empreendedorismo nos seus currículos, também se tornou claro que essa implementação é ainda muito limitada e que o empreendedorismo está longe de ser ensinado a todos os alunos. Também em relação ao apoio à transferência do conhecimento e da tecnologia, todas as universidades estão a participar, mas apesar de alguns bons exemplos de múltiplas estruturas de apoio, em algumas universidades ainda se verifica uma falta de investimento impedindo a plena disseminação e valorização do empreendedorismo.

Palavras chave: Empreendedorismo; Educação; Universidades; Transferência Tecnológica

Resumo Executivo

O empreendedorismo tem vindo a ganhar um crescente interesse em todas as sociedades. Com o novo contexto económico, as empresas pequenas e inovadoras, com um rápido desenvolvimento, são vistas como a base do futuro crescimento económico. Vários autores têm analisado a temática do empreendedorismo, nas suas diversas dimensões, tendo a investigação evoluído entre concepções macro e microeconómicas.

Através da integração de diversas áreas do conhecimento, entre as quais a psicologia e a sociologia, que analisaram a figura do Empreendedor, evidenciou-se a ideia de educação para o empreendedorismo e do seu potencial para a criação de indivíduos dinâmicos e capazes de concretizarem os seus projectos.

Paralelamente, nos Estados Unidos da América multiplicavam-se os casos de sucesso de regiões que se desenvolviam impulsionadas pela actividade empreendedora das universidades, através da transferência e aplicação dos resultados de investigação tecnológica para o meio empresarial.

A experiência americana, em contraste com a crescente perda de competitividade económica Europeia, criou a expectativa de reprodução de um modelo similar no espaço europeu, que suportaria um crescimento económico sustentável. Acreditando que este tipo de crescimento económico tem como base a educação e a inovação, a União Europeia, apelou a uma acção conjunta dos seus estados membros e estabeleceu o objectivo de se tornar na economia mais competitiva a nível mundial baseada no conhecimento. Neste sentido, redobram-se os esforços para a criação das condições favoráveis ao desenvolvimento de uma sociedade empreendedora, nomeadamente apoiando a transferência de conhecimentos e tecnologias geradas no meio académico. Paralelamente as políticas na área da educação objectivaram o estabelecimento de uma aprendizagem para o empreendedorismo.

Nesse sentido, as instituições educativas têm vindo a sofrer por parte dos governos e de todos os envolventes que de alguma forma lhes estão ligados, uma crescente pressão para ajudarem a criar cidadãos empreendedores. As universidades, em particular, estão numa posição proeminente, devido às suas missões fundamentais, ligadas ao ensino e à investigação. Consequentemente, estão aptas a educar cidadãos para o

empreendedorismo e a explorar os resultados da sua investigação transferindo-os para o mercado, através da criação de novas empresas ou colaborando com as já existentes, contribuindo, dessa forma, para a inovação e o crescimento económico. Para esse fim, as universidades devem aderir a uma nova missão contribuindo assim, para o desenvolvimento da sociedade. Nesta perspectiva, o empreendedorismo académico constitui-se como a concretização da terceira missão universitária.

Neste estudo, analisámos a situação das universidades portuguesas no seu processo de adesão ao empreendedorismo, através da promoção do mesmo nas suas comunidades e do estímulo e apoio prestado ao seu desenvolvimento. Foram estudadas catorze universidades públicas portuguesas, no que refere à sua organização, estruturas de apoio ao empreendedorismo e currículos educativos.

Foi possível confirmar a adesão de todas as instituições à terceira missão, contudo verificou-se uma elevada disparidade no nível e forma da sua implementação. Assim, se por um lado, se tornou evidente que todas as universidades estavam a implementar o empreendedorismo nos seus currículos, por outro também se constatou que essa implementação é ainda muito limitada e que o empreendedorismo ainda não integra todos os currículos académicos, conforme as recomendações da Comissão Europeia. Apesar disso, constatou-se uma forte implementação nas áreas de ciência e tecnologia, o que contraria as críticas existentes relativas à sua predominância nas áreas ligadas à economia e gestão. Ficou também evidente a preponderância do seu ensino no segundo ciclo académico.

Em relação ao apoio à transferência de conhecimento e de tecnologia, foi também verificado que todas as universidades têm tido uma participação activa. Contudo, apesar da existência, em algumas universidades, de múltiplas estruturas de apoio que efectivamente contribuem para o desenvolvimento de um ecossistema empreendedor, verificou-se que noutras ainda se constata alguma falta de investimento, nomeadamente ao nível dos recursos humanos e de estruturas de suporte, o que tem vindo a impedir a plena disseminação e valorização do empreendedorismo, contrariando, deste modo, as atribuições definidas pelas próprias instituições.

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List of Abbreviations

CMU – Carneige Mellon University

CETRAD (UTAD) – Centro de Estudos de Transdisciplinares para o Desenvolvimento

CRIA (UALG) – Centro Regional para Inovação do Algarve

DITS (UC) – Divisão de Inovação e Transferência do Saber

EC – European Commission

GAPI – Gabinetes de Apoio à Promoção da Propriedade Industrial

GDP – Growth Domestic Product

GEM – Global Entrepreneurship Monitor

HEI – Higher Education Institution

INEGI (UP) – Instituto de Engenharia Mecânica e Gestão Industrial

IP – Intellectual Property

IPN – Instituto Pedro Nunes

ICAT (UL) – Instituto de Ciência Aplicada e Tecnologia

INESC (UP) – Instituto de Engenharia de Sistemas e Computadores

IUL-ISCTE – Instituto Universitário de Lisboa - ISCTE

IST (UTL) – Instituto Superior Técnico

KTO – Knowledge Transfer Office

MBA – Master of Business Administration

MIETE – Mestrado em Inovação e Empreendedorismo Tecnológico

MIT – Massachusetts Institute of Technology

OECD – Organisation for Economic Co-operation and Development

OTIC – Oficinas de Transferência de Tecnologia e Conhecimento

OU – Organic Unit

R&D – Research and Development

SME – Small and Medium Enterprises

UA – Universidade de Aveiro

UAC – Universidade dos Açores

UALG – Universidade do Algarve

UBI – Universidade da Beira Interior

UC – Universidade de Coimbra

EU – Universidade de Évora

UL – Universidade de Lisboa

UMA – Universidade da Madeira

UMI – Universidade do Minho

UNL – Universidade Nova de Lisboa

UP – Universidade do Porto

UPIN – Universidade do Porto Inovação

US – United States

UTAD – Universidade de Trás-os-Montes e Alto Douro

UTL – Universidade Técnica de Lisboa

TTO – Technology Transfer Office

VC – Venture Capital

1. Introduction

In recent years, the interest on entrepreneurship has raised, due to economical needs and political pressure. With the growing levels of unemployment, existing enterprises are not capable of absorbing the total population in labour market. Therefore entrepreneurship is viewed as a manner of creating new companies and job places, and a strategy for self-employment creation. These new companies are expected to be small (SME) but very innovative and that is seen as the future base of the world economy (Birch, 1981).

Academic entrepreneurship is a form of entrepreneurship based on universities' activities. The idea is that universities promote entrepreneurship in their community and region, by practical teaching and training of their students and by raising the region's awareness, favouring firm creation through transfer of knowledge, science and technology to the market. This activity is crucial to implement the "knowledge based economy", which is a worldwide preoccupation and a European imperative (Lisbon Strategy, European Parliament, Presidency Conclusions, 2000).

Academic entrepreneurship has been interesting researchers and academicians since the 1980s. With the adoption of the Bayh-Dole Act (1980) in the United States, the right to own and license inventions has moved from the federally funded research to universities. Since then, many European countries have adopted similar legislation on ownership and rights on inventions. As a consequence, entrepreneurship activities in universities have turned into a central concern (Wright *et al.*, 2007) and the commercialization of inventions from universities has suffered a remarkable raise in the form of patenting, licensing, research joint ventures and the creation of spin-off companies.

In the US this topic is well explored and well implemented. Due to its success, European universities have tried to reproduce a similar environment and since the 1990s there has been a proliferation of technology transfer offices, incubators and science parks in European universities which have embodied the mission of promoting academic entrepreneurship. As it is a more recent concern in Europe, and considering the European scenario of the different countries, cultures and policies, there is no homogeneity in the levels of development and implementation.

In Europe there are several studies on the topic, comparing the policies and levels of development among countries. However the Portuguese case is poorly referred to, even

if there is a growing interest about it within the country, captured by the constant increase in the number of studies, most of them consisting on thesis of post-graduate students, developing case studies in specific institutions or comparisons between two, usually successful, universities. But there is a lack of studies analyzing the Portuguese situation of entrepreneurship promotion in universities through its different dimensions, as a whole and building a base for comparing its experience with others among Europe. And this is exactly the intent of this study: to analyze the Portuguese experience of universities entrepreneurship promotion and support. We intend to analyze the situation at each Portuguese public university, to compare it between each other, according to the literature on the topic and the Portuguese and European context, and eventually to come up with a benchmark of the best practices in use. This would enable each institution to know what their neighbours are doing, to acknowledge their actual situation, and to eventually adapt / implement other measures. This study will therefore fill the gap in the European panorama of studies on entrepreneurship, with the description and analysis of the Portuguese experience.

1.1. The concept of entrepreneurship

The concept of entrepreneurship is not new. It was introduced by a French economist in the XVIII century, Richard Cantillon, in *Essai sur la nature du commerce en général*, 1755, and it derived from the French words “entre” and “prendre”, meaning taken in between, referring to a position in the market between the furnisher and the consumer. The entrepreneur was a productive agent, combining different inputs to produce goods. It had a subjacent idea of taking a financial risk, by buying products at a certain price and trying to sell them at a higher price. The concept was used by subsequent economists along the XIX century, like Jean Baptiste Say, John Stuart Mill and Carl Menger, who developed the idea related to the creation of value by taking risks and managing a business.

The actual meaning of entrepreneurship was introduced in 1934, by Joseph Schumpeter who sat up the link to innovation, defining entrepreneurship as a process of creating through destruction. For him, the entrepreneur was an agent of change, introducing in the economy new goods or new methods of production which result in the obsolescence of the old ones as a disruptive force.

According to a study from Santos, C. and Teixeira, A. (2009) who analyzed the evolution of literature on entrepreneurship, after Schumpeter and until the mid-1970s,

the entrepreneur disappeared from the economic literature. However when it resurfaced in the seventies, it focused on a microeconomic perspective. It also became a research interest in different areas beside the economic field, such as sociology, psychology, and economical geography until at last, it affirmed itself as a separate intellectual domain (Stevenson, H. 2000). Morris, M. (1998) identified seven perspectives of entrepreneurship, in the literature: wealth creation, firm creation, creation of innovation, change creation, creation of employment, creation of value and creation of growth. However, it is difficult to find a definition of this concept that embraces all its forms and its essence and which is also accepted by all the scholars. Some authors have even proposed that due to the impossibility of consensus on a unique definition, each researcher should present its own, according to what he/she intends to study (Bygrave, Hofer, 1991)¹.

Nowadays, the concept of entrepreneurship is linked to innovation. In this sense entrepreneurship is not solely the creation of a new venture. An entrepreneurial firm is one that is pro-actively looking for growth, without being restricted to its own resources (Morris, M., 1998) and it implies the creation of new needs and new consumption (Drucker, P. 1985).

Stevenson, H. (2000: 1) defines entrepreneurship as “*the pursuit of opportunity beyond the resources that you currently control*”, and this definition is commonly used by the Harvard Business School. He argues that individuals can become embedded in contexts that facilitate the recognition of opportunity and its pursuit.

Entrepreneurship has been studied in a holistic manner, from very different perspectives opening the way to new approaches in this field, such as economic development, corporate entrepreneurship, social entrepreneurship, educational entrepreneurship, ethic entrepreneurship, and so on.

In a macroeconomic perspective, entrepreneurship has been analyzed for the purposes of innovation, policy, regional development and growth (Santos, C. and Teixeira, A. 2009). Regarding economic development, entrepreneurship is seen as a motor (Birch, D. 1981). In this approach, scholars analyze the role of entrepreneurship and discuss policy instruments and interventions to foster it, once it is considered a way of creating new businesses, and specially self-employment that responds to the societal and industrial changes.

¹ Cited by Sarkar, S. (2010)

On a regional perspective, entrepreneurial activity is considered to vary according to the different regional opportunities and capabilities which may explain the differences in the start-up rates across regions (Audretsch, D.B. and M. Fritsch, M. 2002). Regional disparities in knowledge stock, research and development investment and the degree of implementation of knowledge spillovers have an impact on the level of entrepreneurial activities in each region. In the regional perspective, the role of research and higher education institutions, along with the roles of industry and government, and their interactions are crucial to foster entrepreneurship and innovation in specific regions. Scholars in this perspective studied the different contexts and environments that favour entrepreneurship, the actors involved and the relations between them, as well as the transposition of strategies from one region to another. At the end, they try to identify the optimal conditions that should be created to successfully establish an effective entrepreneurial environment.

Along with the studies on entrepreneurship, the entrepreneur, as an individual actor, has also been studied. The psychological approach of entrepreneurship analyzes the characteristics of the propensity of an individual to be entrepreneur and whether people are born natural entrepreneurs, or become an entrepreneur by learning (Timmons; 1989)² and being exposed to specific atmospheres (Gibb 1987)³. Accepting that it is possible to explore the individuals' characteristics that are needed to undertake (*entreprendre*), the perspective of entrepreneurship education can be conceived.

These perspectives will constitute the basis of our analysis in this study. For the purpose of this study, entrepreneurship is seen as a process of pursuing value creation through the identification of opportunities and innovation. In the next sections we will analyze one specific perspective of entrepreneurship, that of academic entrepreneurship.

1.2. Structure of the thesis

In this study we will analyse academic entrepreneurship in two dimensions, the educational one and the knowledge and technology transfer one.

The population to be observed are the Portuguese public universities. The criteria that will be used are the forms of promoting entrepreneurship that are in use in Portuguese public universities, if they are following a proactive policy (push-strategy), or rather a

² Cited by Sarkar, S. (2010)

³ Cited by Sarkar, S. (2010)

reactive one (pull-strategy). This will be an exploratory study and the data analysis will be predominantly qualitative. The study was based on statics and studies, participation in conferences on the theme, seminars and interviews, as well as on the direct observation of specific institutions. The methods of gathering data are observation, data survey and interviews.

In this first chapter we have presented the introduction which includes the field of the study, the main goals and the current structure of the thesis.

In the second chapter we will present the theoretical frameworks on the study of academic entrepreneurship. We will analyze the capability theories, the organizational theories and the educational ones.

In the third chapter we will follow with the presentation of the European environment for academic entrepreneurship. We will start by providing the European general framework for entrepreneurship, economically and politically, and then specify the Higher Education situation.

In the fourth chapter we will focus on entrepreneurship in Portugal, presenting the Portuguese performance, its entrepreneurship policies, and the higher education reality.

After presenting the general framework of our study we will dedicate the fifth chapter to the methodology used to provide an empirical study on the Portuguese public universities' approaches to entrepreneurship education and promotion, as well as the limitations related to this study.

We will then present the empirical findings of our study in the sixth chapter. We will present our findings on the Portuguese academic entrepreneurship, analyze the cases and compare them.

Finally we will conclude this thesis, by presenting the relevant results of the study and its implications for further improvement of the Portuguese reality.

2. Academic Entrepreneurship –A Theoretical Framework

As previously stated, both conceptions that innovation is the motor of economic growth development and that entrepreneurship is learnable, introduce an opportunity for higher education institutions to entail a new entrepreneurial mission. Academic entrepreneurship has been studied both in a macroeconomic and in a microeconomic perspective (Santos; C. and Teixeira, A. 2009). In the microeconomic perspective, studies focus on the promotion of entrepreneurship within the institution, the universities' actions and incentives directed to its community and region. In the macroeconomic perspective the scope is on universities as agents that stimulate the emergence of new firms and that promote technological and scientific diffusion.

In this chapter we will start by analysing the macroeconomic perspective of academic entrepreneurship, by analysing its approaches on a regional perspective and as a means to foster economic development. We will then analyze the different dimensions of entrepreneurship that we will be using in this study, defining each of them and identifying and describing the different associated theories, namely: entrepreneurship education and the promotion of scientific knowledge and transfer.

2.1. The Macroeconomic perspective

In the macroeconomic approach, as previously referred, entrepreneurship in universities is perceived as favouring economic growth and regional development. Education and technology transfer have been recognized by scholars and policy makers as promoters of regional entrepreneurship, favouring economic development. Within this perspective, studies have been focusing on the benefits of knowledge and technology transfer. Most recently, however, the research on entrepreneurship education has increased, and gained more importance within this perspective.

Scientific knowledge and technology developed in institutions funded by the state (research centres and universities), have been recognized by scholars at least since the mid 70s (Rosenberg, 1974)⁴ as a source of pace and innovation. The concept of an entrepreneurial university in a perspective of an agent transferring knowledge and

⁴ Cited by Siegel, D. (2007)

technology goes back into the 80s, when specific legal conditions were issued in the US, which created the possibility for universities to value commercially the knowledge and inventions produced. With the introduction of the Bayh-Dole Act (1980), the right to own and license inventions has moved from the federally funded research to universities. The impact on society from activities of transfer of knowledge and technology is usually studied on a regional perspective due to the successful US examples of Silicon Valley, MIT or Chalmers on regional economic growth. Many European countries have adopted similar legislation on the rights on scientific and technological knowledge created by state funded research. However it seems that the high entrepreneurial environment that flourished in the US was difficult to transpose to Europe.

In what regards the role of education, Matlay (2006; 2008)⁵ considers that entrepreneurship education is perceived by influential stakeholders as an efficient and cost effective process of providing the market with an increasing number of entrepreneurs. Entrepreneurship education has been conceived on a regional perspective because of the importance of geographic proximity, face-to-face contact and knowledge spillovers, which are essential for the transmission of tacit knowledge (Audrescht, D. and Phillips R.; 2007).

In fact it has been demonstrated that some regions had greater entrepreneurial potential than others, and that the penetration of an entrepreneurial culture through investments in education and innovation was efficient on those regions. It is clear that investments in knowledge and research are necessary to favour economic growth. However, it has also been verified that these investments alone were not sufficient for generating innovation and growth (Audrescht, D. and Phillips, R.; 2007). There are differences in regions' opportunities for profit that systematically influence the impact of entrepreneurship education (Santos, C. and Teixeira A.; 2009). Scholars have been studying the reasons for these existing regional differences in terms of absorption.

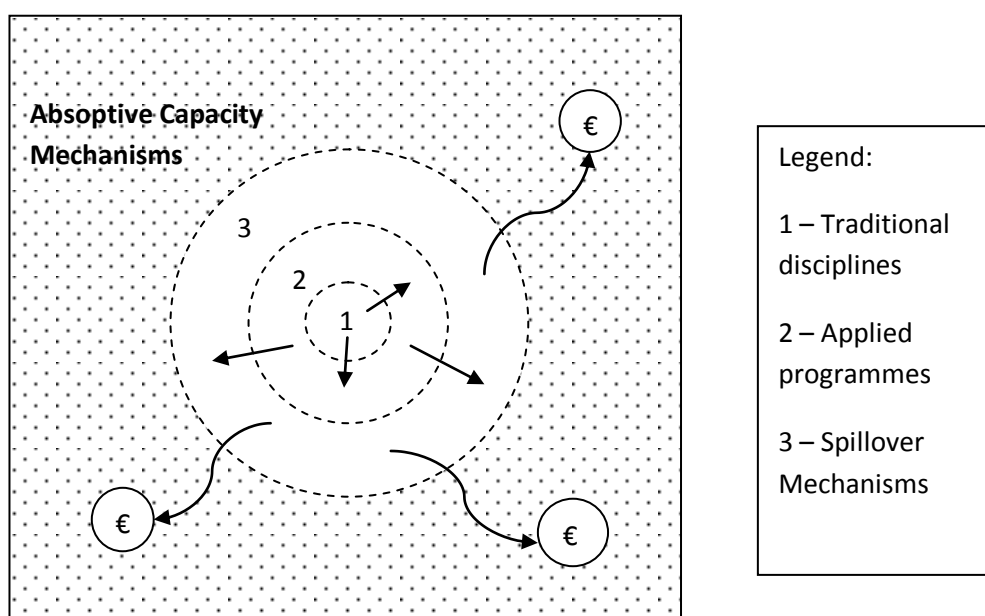
Acs, Z., et al (2003) consider that there are two conditions that must be fulfilled, to enable that an increase in the stock of knowledge in a region (through education and research) may lead to a positive impact on its economic growth: (1) knowledge needs to be economically useful and, on the other hand, (2) economy must be endowed with

⁵ Cited by Paço A., et al. 2010

factors of production capable of selecting, evaluating and transforming knowledge into commercial use.

According to Audrescht, D. and Phillips R. (2007), the differences in the level of entrepreneurship absorption among regions are due to a “knowledge filter”, a barrier avoiding the spillover of knowledge from its origin to a third party. To enable the creation of innovation and growth in a region, knowledge investments have to penetrate the knowledge filter. To surpass this barrier, the authors present a concept of entrepreneurial university based on three levels (See Figure 2.1.). The first level consists on the traditional basic disciplines. On the second level they positioned the applied programmes which are much more market oriented and contributing to society. As these two levels by themselves do not generate sufficient knowledge spillovers from the source, they added a third level to penetrate the knowledge filter, consisting in the support mechanisms aimed at transferring the knowledge and technology resulting from education and research – the technology transfer offices, incubators and science-parks. This third level is considered to be the conduit facilitating the knowledge spillovers from the first two levels to the region and the economy. The authors consider the role of the university as a whole, in all its dimensions, not limited to education. Considered as a whole, university entrepreneurship is perceived as a mechanism that permeates the knowledge filter. Entrepreneurship education is one of the available means to this end (Audrescht, D.; 2006).

Figure 2.1.: The Entrepreneurial University



Source: Audrescht, D. and Phillips R. (2007)

According to these environmental conditions, as stated by Goddart and Chatterton (2003)⁶, there is a challenge for universities and for regions that have to interact in a value-added management process. Universities need to establish links between teaching and research activities and community roles. This linkage should be accomplished by activating internal mechanisms, such as raising entrepreneurship awareness; staff development, funding (etc.). The challenge for the regions is to engage in the different aspects of the university's development process, as skills improvement, technological development and innovation, and cultural awareness.

There is a strong debate on the impacts and results of the transfer of technology and knowledge from universities raising questions as to whether or not it creates wealth, scientific advance, wealth for the university and successful ventures.

Departing from the premise that entrepreneurship education can transfer some entrepreneurial know-how to the regions, and upon the results of some studies (Peterman and Kennedy, 2003; Souitaris et al. 2007) demonstrating contradictory impacts, or no effects, and taking in consideration Audrescht and Frisch's spillover theory, Dohse, D. and Walter, S. (2010) analyze the impact of entrepreneurship education in different regions in Germany. In regions with higher start-up intensity⁷ and with greater human capital density⁸, the impacts of entrepreneurial education regarding the students' intention to create a start-up, is higher. This can be explained by the regional knowledge spillovers occurring in those regions, which consist in the existence of networks, specialised knowledge and informal knowledge transmission, consisting in a credible example of employment alternatives for students

Technological advance has however been recognized by most, as being the driving force for economic growth and scientific knowledge as the key for innovation (Mayntz and Schimank; 1998)⁹. Universities have therefore an undeniable opportunity to occupy a preponderant role in innovation and economic development.

Policy makers are highly aware of the importance of universities in the knowledge based economy. Governments have taken measures to create a framework to promote an entrepreneurial culture and the exploitation of basic science and technology. In Europe, since the 1990's a number of different initiatives and support measures at national levels

⁶ Cited by Paço, A. et al. (2010)

⁷ Start-up intensity consist in a region's frequency of start-up creation

⁸ Human capital density refers to the share of highly qualified individuals in a region's labour market.

⁹ Cited by Rasmussen, E. 2009

have been endorsed, including incubators, early stage funds and technology transfer offices at public research institutions.

Despite these policy measures, universities' initiatives to actively promote the entrepreneurship education and knowledge and technology transfer have not been sufficiently studied. In fact the governments' pressure on institutions has been increasing for economic reasons, but the level of adjustments by universities has been poorly investigated (Martin and Etzkowitz, 2001)¹⁰.

Although the role of universities in contributing to the regional development has been recognized by scholars and politicians, there is a need for higher education institutions (HEI) to accept this role as a formal engagement to their region (Goddart and Chatterton; 2003)¹¹. Some scholars refer to the emergence of a third mission for universities, beyond the traditional roles of teaching and research, consisting in the transfer of knowledge and technology for the purpose of regional development¹². This requirement for a regional engagement is a new overall trend for universities that presupposes that they have a capacity of response and are willing to adopt a pro-active attitude to develop themselves as entrepreneurial institutions (Galloway et al., 2005)¹³.

Therefore universities must play a proactive role in entrepreneurship, by linking its different roles and combining its resources to transform them into value. We will analyze each of these dimensions in the following section.

2.2. Entrepreneurship Education

Entrepreneurship education has been poorly explored in the entrepreneurship literature. Studies on entrepreneurial universities have focused on productivity of the technology transfer offices; new firm creation and on the environmental context. (Santos; C. and Teixeira, A.; 2009) In our perspective, however, to study academic entrepreneurship, it is necessary to analyze each dimension of the universities, and their combination, as they are all parts of the same mission of an entrepreneurial university.

¹⁰ Cited by Rasmussen, E. (2009)

¹¹ Cited by Paço, A. et all (2010)

¹² There is no consensus on what the third mission is. For some authors it consists on transferring knowledge and technology produced (Wright et al., 2007), on capitalization of knowledge, (Etzkowitz, 2008) or regional development (Goddart and Chatterton; 2003, cited by Paço; 2010). However, according to what has been analyzed in this section, we admit that there is a convergence in these affirmations, once they are all related to the impacts of knowledge and technology transfer.

¹³ Cited by Paço, A. et all (2010)

We will focus the analysis of this chapter on entrepreneurial education. We will try to understand why it is important and which are the objectives and the public, and how it can be done. Our scope is not to provide a pedagogical analysis, but rather to emphasise the necessity of taking education into consideration. We will therefore start by remembering the importance of Entrepreneurship education on building entrepreneurs, we will continue in the perspective of its importance for regional purposes and finally we will overview how it can be undertaken at the university level.

2.2.1. Building entrepreneurs

As we have previously stated, there has been some debate among scholars to understand if entrepreneurship is something that can be taught. Some authors who have studied entrepreneurship characteristics in individuals, within a psychological and behavioural approach, consider those characteristics as individuals' temperamental traits that are stable over time (Reber, A.; 1995)¹⁴. In a study about successful entrepreneurs in India, McClland (1987)¹⁵ identified nine characteristics that distinguished very successful entrepreneurs from median entrepreneurs, which are: Initiative; communication capacity; understanding the opportunities; efficient orientation; quality oriented; systematic planning; monitoring; endeavourer of the work contract and acknowledgement of business networking. Some of these characteristics, even if they are not totally learnable, can certainly be improved by specific methods and in particular contexts. Particularly characteristics related to business know-how and business capacities are learnable. Various studies consider that the entrepreneurial role can be culturally and experientially acquired, and in this context education and training can be seen as a tool (Vesper et. Al; 1989)¹⁶. Even if some individuals appear to have more entrepreneurial traits than others, entrepreneurship needs to be promoted in those individuals where entrepreneurial traits may flourish (Sarkar, S.; 2010). According to Porter, M. (1985) entrepreneurship is a practice and has a knowledge base, supported by economic and societal theories. Based on these assumptions, entrepreneurship education has gained acceptance. Entrepreneurship education is relevant because nurturing potential entrepreneurs along their education and training path, in a lifelong perspective, may result in raising the number entrepreneurs as well as their successful achievements.

¹⁴ Cited by Sarkar, S.; 2010

¹⁵ Cited by Sarkar, S.; 2010

¹⁶ Cited by Fleming, P.; 2004

Entrepreneurship education has been first introduced in higher education level, due to its market and environmental conditions that allowed for an entrepreneurial response. However the awareness of entrepreneurship education's capabilities to influence individuals is growing, as it is observed by its introduction at different levels of education, starting in primary-schools (Fleming, P., in Vilarinho, P., 2004).

In what concerns higher education, entrepreneurship education is aimed at teaching the basic employment skills and to provide students with the know-how to start and run a business. According to De Faoite et al. (2003)¹⁷ it contributes to the integration of a variety of business subjects, to improve decision-making skills and to encourage technology transfer from the university to the market and its synergies. For Brown, T.; (2002)¹⁸ it is a means to inculcate in students the skills to build a business, but more importantly to take responsibility and initiative. But education and universities are also perceived as crucial instruments that stimulate the emergence of new industries and promote scientific knowledge and technological diffusion (Santos, C. and Teixeira A.; 2009), favouring the acceleration of entrepreneurship, innovation and economic growth (Audretsch, D. and Phillips; R. 2007). In fact, several authors have pointed out the importance of the integration of entrepreneurship education in universities for local and regional development, as we will see in the next section.

2.2.2. Entrepreneurship education

We argue that universities regard education as a formal transfer of knowledge in typical academic curricula that can have active and reactive components, but they also recognise the need of spillovers of knowledge at education level, which are a product of informal education activities that are conceived to raise the entrepreneurial awareness in the academic community. In this section we will explore the conceptions of formal and informal entrepreneurship education.

Historically entrepreneurship education has suffered different waves of development. According to Fayolle, A. (2007), the first wave of entrepreneurship education occurred after the Second World War and was spread through agricultural researchers, in a model known as "agricultural extension". The second wave consisted on the extension of this model to business schools and business development specialists, and is known as the

¹⁷ Cited by Paço A., et al. 2010

¹⁸ Cited by Paço A., et al. 2010

business “school-based approach” (Katz, A.; 2006)¹⁹. Finally, we are now witnessing to the third wave of entrepreneurship, in which entrepreneurship education is conceived as transcending academic fields, thus implementing a multidisciplinary approach across university’s campuses (such as technology faculty and business school), and which is called cross-campus entrepreneurship (Fountain, 2004)²⁰ or academic entrepreneurship (Shane; 2005).

At the present time, it is important to consider the trends occurring in higher education, such as the diversification of students, by captivating new publics usually with working experience, the changes in technology and internationalisation, pushing universities to rethink their organizational learning concepts and theories (Paço, A. et al 2010). There is also a growing necessity of meeting students, graduates, employers and the society educational needs and expectations. In this sense we consider that with the number of existing universities and the global offer and competitiveness, universities tend to be viewed as service providers that need to guarantee quality and to respect and meet stakeholders’ expectations. Entrepreneurship education is no longer limited to business schools, instead different academic fields of knowledge have also implemented it in their curricula, such as in science, technology or design fields. An experience-based approach supported by knowledge transmission in traditional settings seems to best meet the new requirements of an entrepreneurial society.

As suggested by Doshe, D. and Walter, S. (2010) there are different modes of educating for entrepreneurship, according to the regions realities. The authors distinguished the modes in which entrepreneurship should be taught: in an active mode (hands on approach based) or in a reflective mode (theory based). The authors consider that both educational modes are effective in regions with high start-up intensity and with high human capital density. In regional context with lower start-up intensity and human capital density, active modes of entrepreneurship education appear to be more effective. It seems central to establish the educational objectives of entrepreneurship education according to the field in which it is taught. Kingon A. and Vilarinho, P. (in Vilarinho, P. et al. 2004) claim that it is crucial to clearly and transparently state the goals of entrepreneurship education, in terms of the skills and the expected students’ career paths. To this end, they identified three different expected outcomes to be developed in students: entrepreneurial orientation and motivation; specific product or entrepreneurial

¹⁹ In: Fayolle, A. 2007

²⁰ Cited by Katz, A. in Fayolle, A. 2007

skills; and personal and team entrepreneurial skills. The authors consider that curricula with an emphasis on entrepreneurial orientation and motivation are usually found outside business-schools, and generally consist in optional single semester courses at undergraduate level. The goal of these courses is to display to the students alternatives to the traditional career paths, such as self-employment and start-up venture creation. These courses tend to follow a reflective approach. Other curricula have a broader emphasis, recognizing that entrepreneurial qualities are critical for value creation in different contexts, and are aimed at developing in the students personal and team-based entrepreneurial skills. In this case, the practice-based approach is essential to develop the stated skills in the students. It is common for this type of programmes to be organized transversally between different academic fields (cross-campus approach). Finally, the curricula that are aimed at impart in students specific product or enterprise skills that will allow them to create their own venture should be pedagogically dependent upon the type of venture (small business, high growth venture) or product expected (product development, technology-based new venture). In some cases it could require specific infrastructures, network and support. The authors came out with the idea that there is a lack of academics appropriately qualified to teach entrepreneurship education combining both the academic requirements and the real experience needed (Katz; 2003). As a response to this problem, they encourage the cross-campus collaboration and research programmes between business schools and the other faculties, even if they consider it as only a partial solution.

Ultimately, scholars that study entrepreneurship education consider it critical to develop in the students the eagerness to start new ventures. In the case this does not prove, they still consider that even if the students do not create a start-up, at least they will possess the necessary characteristics and traits for success in any endeavours (Rabbior, G. In Kent, C. 1990). Levie, J. (in Vilarinho, P. 2004) suggests that it is a positive outcome that some students realize that they should never start a business.

We have overviewed some critical questions about entrepreneurship education, however the universities activities are not limited to education and research within a formal approach, there are a number of parallel activities occurring at campuses, a great part of which consisting in informal education.

Entrepreneurship education is taught formally in different academic fields. However an important part of the academic life consists in extra-curricular activities, offered to the academic community in optional-bases that complement the academic development.

Informal activities in entrepreneurship education are aimed at raising awareness about this topic in the academic community and support the ongoing process of knowledge creation. Usually they are directed to students, academic professors and researchers.

Activities organized by TTO and Entrepreneurship centres, some of them linked with regional or state programmes, such as business plan competitions, mentoring, special days of awareness creation, conferences presented by entrepreneurs and involvement of former students that have started their own venture; reinforce the entrepreneurship culture within the institutions.

It is not sufficient to provide students with good entrepreneurship education, they must be surrounded by an environment within which they can practice entrepreneurship, and which will encourage this practice (Levie, J., in Vilarinho, P. 2004). Informal education has then a complementary role to the students' career paths, by involving students in a series of initiatives outside the normal "classrooms".

According to Etzkowitz, H. (2008), universities should integrate entrepreneurial activities into their regular academic work, allowing entrepreneurial training to every student. As important as learning to write a personal essay and scientific papers, students should learn the methods to write a business plan, to design a project, as well as to accomplish market tests. The author claims that incubators should be located near the students' everyday surroundings, within each department along with laboratories and classrooms. It is critical that academics and researchers actively participate in commercialization activities and in firms' organization, in order to promote the entrepreneurial culture, being a model and thereby encouraging more their colleagues and students, instead of just lecturing simple theory application.

2.3. Entrepreneurship through knowledge capitalisation

Entrepreneurship through the transfer of knowledge and technologies from universities has been studied according to different perspectives. As the first studies on entrepreneurship had a tendency to look at the problematic in a macroeconomic perspective, the first studies on academic entrepreneurship have also started with an overview of the situation and a top-down approach. More recent studies have however concentrated on the analysis of the process at close scale. In this section we will analyze the different literature perspectives. We will first address the policy level perspective, then we will focus on the institutional perspective. But first we will define the spin-off

concept, as it is in the centre of attentions within technology transfer of academic entrepreneurship perspective.

As well as for entrepreneurship, it is also very difficult to find a consensual definition for spin-off. However there are some consensual features that are commonly addressed when defining a spin-off, as the transfer of technology and/or human capital from a parent organization to the new venture. According to Brett et al. (1991)²¹, a spin-off is a company producing products or services originating from research developed in a university. On another hand, for Roberts, E. (1991) a spin-off is any firm founded by anyone who worked or studied in a university. For Vohora et al. (2004: 149)²² a spin-off is “*a venture founded by the employees of the university around a core technological innovation which had initially been developed at the university*”. For Rasmussen, E (2009) a spin-off is a new venture initiated within a university and based on its technology. Wright, M. et al. (2007) defines academic spin-offs as new ventures whose creation is dependent upon the licensing or assignment of an IP from a university. In some cases, universities may own equity in the spin-off, usually due to the patent rights assignment or as license fees. For the purpose of this study, we will consider as spin-off new ventures created to explore commercially the knowledge or the technologies which result from research developed in a university, and which were founded by someone who has (or has had) a formal link to the institution (students, professors, researchers, administrative staff or former student). Our definition is in line with Vohora’s (2004) conception.

2.3.1. The policies to promote knowledge and technology transfer

As stated before, national governments have implemented several measures to promote knowledge and technology transfer, in order to foster economic development. Wright, M et al. (2007) grouped these different initiatives into five categories: (1) programmes dealing with researchers’ statutes; (2) initiatives intending to train the academics on business principles; (3) programmes for regional stimulus through financing of bottom up projects; (4) programmes based on incubation activities and finally (5) some programmes related to seed financing of spin-offs. The authors emphasise the difficulty in evaluating the national policies, because of the fact that these programmes differ

²¹ Cited by Rasmussen, E. (2009)

²² Cited by Wright, M. et al (2007)

among countries, and in some cases they are not limited to foster entrepreneurship at universities' level but also because they are too recent. It is clear however that there is some debate on the impact of some of these initiatives and about the level of their frameworks, whether it should be regional, national or European. Nonetheless, one cannot deny the necessity of national policies to address problems of legal and financial environments, which have been recognized as the major obstacles for spin-off development.

Regarding the legal framework, several studies have focused on Intellectual Property (IP), regulation facilitating the transfer of technology and the regulations of academic public careers in Europe. According to Wright, M. et al. (2007: 1), "*The Bayh-Dole Act legitimated the involvement of universities in technology commercialization and spin-off activities at US universities*", providing universities with rights on research results developed within the institution, even when financed by the Government. It is crucial to implement adequate IP regulation, as its lack combined with tacit knowledge can be an obstacle to the transfer of technology, since licensing may be problematic (Shane, 2001).

Regarding academic career, the traditional career path consists in research, teaching and administration, rather than in commercial activities. In fact, in most European countries the majority of academics in public universities are public servants. On the other hand, there are many researchers who are not civil servants, but have a financial contract at national level, receiving grants to develop specific projects, which are usually very restrictive in what concerns full-time dedication. Therefore, it may either be impeditive for an academic or a researcher to get involved in a private company, or at least they will be limited in their time availability for it. As these commercialization activities are not considered in terms of academic career progression, or are not allowed by the national grants system, it has been a problem to motivate academic scientists to create spin-offs (Jensen and Thursby, 2001)²³. Therefore the starting of commercialization activities may be a source of conflict for researchers within the institution. This stresses the need to understand the benefits of commercialization as well as how wealth can be created in universities' context. In this sense there is a need for revising regulations on the academic career path, in accordance to the new academic reality and to the

²³ Cited by Wright, M. et al (2007)

European and national goals of promotion of an entrepreneurial culture in academic institutions and spin-off formation.

In what concerns financial matters, the lack of venture capital has been a main concern in the studies about academic spin-off creation. One of the main problems in Europe is the lack of venture capital (VC) investment in early stage-of-development firms. European governments have tried to respond to this problem by creating early-stage funds, sometimes in the form of pre-seed funds, or in the form of public-private partnerships to finance high-tech start-ups. Another measure which has been implemented consists in the creation of guarantee schemes to reduce the risk of investment. Also an indirect financial measure usually employed has been the introduction of fiscal incentives consisting on tax relief on income for private investors (Wright, M. 2007).

Another issue that has been addressed by national policies to foster the transfer of technology and the promotion of spin-off creation has been the support and promotion of these activities within the institutions, through the creation of specific support structures. Several institutional arrangements have been set up at universities to facilitate knowledge and technology transfer as well as their commercialization, such as technology transfer offices (TTO), incubators and universities' seed funds. However, neither the existence of these structures by themselves, nor support funds alone are enough to favour the transfer of technology and the rising of a dynamic spin-off sector (Wright, M. et al; 2007). There is a need for a pro-active activity by TTO structures, in order to obtain successful results. We will analyze this topic more in depth in the following section.

2.3.2. The institutional perspective

Research on the entrepreneurial dimension of universities through technology transfer has been concentrated in the activity of spin-off firms' creation.

In this perspective the units of analysis are the university and the existing support services, the researcher and the entrepreneur, the spin-off and the stakeholders. Scholars study the relations and interactions between the different actors, the process of firm creation, the performance of the firms, the models implemented and the existing structures. The subjacent idea is that to be entrepreneurial, universities should promote and facilitate spin-off firm formation.

As referred previously, the adjustment of universities to the European, national and regional policies has been considered to be poorly explored. However there are a growing number of recent studies focusing on the institutional arrangements to facilitate spin-off creation and therefore enabling institutions to meet their regional entrepreneurial objectives.

In his study on how universities may facilitate spin-off ventures, Rasmussen, E. (2009) identified the different approaches that have been used in the institutional perspective and analyzed the weaknesses and strengths of each one of them:

Table 2.2.: Strengths and weaknesses of perspectives on university capabilities

Theory	Purposes	Strengths	Weaknesses
Descriptive	Identify characteristics and causes associated with spin-off formation	Simple and revealing	Do not provide explanations
Evolutionary	Describe changes at population-level and study of clusters of organizations	Considers the competitive environment	Fail to explain variations and emerging processes
Strategic choice	Based on a rational analysis of the environment and choosing the right strategy to achieving desired outcomes	Considers the institutional strategy	Emphasizes the capacity of choice and implementation
Resource-based	Identify the university resources leading to spin-off formation	Considers the heterogeneity in spin-off process	Does not explain how resources are developed
Capability	Identify organizational routines and processes to facilitate spin-off formation process	Adapted to idiosyncratic spin-off processes. Incorporates change	Not too developed, and tends to be complicated.

Adapted from Rasmussen, E. (2009)

In this section we will analyze individually some different perspectives of the literature, focusing on the institution and its support services.

2.3.2.1. The Descriptive theory

In fact one of the main themes addressed in the descriptive perspective on academic entrepreneurship literature is the technology transfer office. Studies analyze the role of TTO within the institution, its activities, goals and resources.

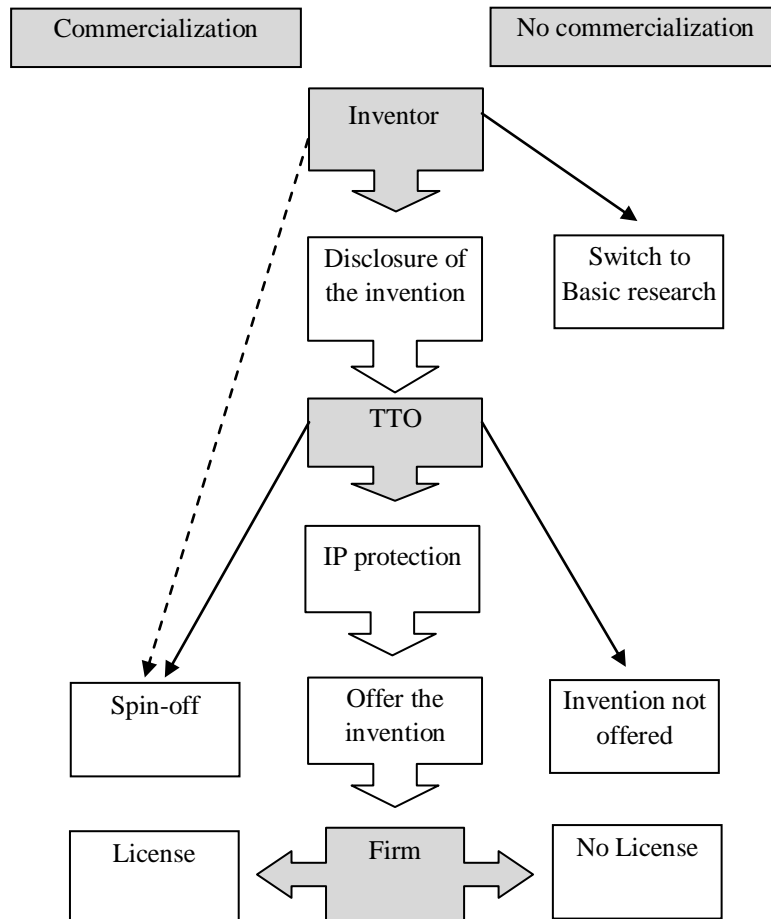
In a study on European academic entrepreneurship, in which a comparison is made between the initiatives and procedures taking place in five different European countries (France, United Kingdom, Sweden, Belgium and Germany), Wright et al. (2007), state that a university which engages in spinning-off activities can adopt a range of support activities to facilitate the venture creation by providing the resources and capabilities needed for the development of new ventures. However the ability to provide the necessary support activities may vary between institutions. Though the authors assert that the number of spin-off firms created seem to be closely related to the expenditure on IP protection and to the business development capabilities of the technology transfer offices.

Technology transfer offices (TTO) are structures that have been developed in Public Research Organizations to address the topics previously analyzed in the policy makers' perspective. According to Vendrell-Herrero, F. (2009), the TTO structures are responsible for the protection and commercialization of universities' intellectual property, and an intermediary between researchers from whom they receive the disclosed inventions to be commercialized, and firms which will use the innovation in their organization or for the development of new projects. The activities of technology transfer offices traditionally consist in patenting, licensing research joint ventures with private companies and the creation of spin-off firms. The budget of these offices is partially generated by the income of these commercial activities (Siegel et al., 2003). According to the quality of the inventions disclosed, the strategy of the university and the interest of the researcher, TTO's role is to present the different possibilities of technology transfer to each particular invention and to support the decision on the best option. In Figure 2.3. we present the TTO decision on technology transfer.

Vendrell-Herrero, F. (2009) argues that despite the relevant specialised services provided which can justify its presence, TTO mainly exists for the purpose of building a reputation which will allow parties (university, researchers and firms) to reduce information asymmetries, which ultimately will avoid adverse selection problems regarding the level of quality of the projects. For Siegel et al. (2007), the role of TTO may have another important feature within the universities themselves: the role of an

institutional entrepreneur that works toward the legitimacy of new technologies and inventions. Therefore, TTO has three main roles: protection, propagation, and influence, such as the latter it is more than merely technology transfer, it is proactive technology transfer:

Figure 2.3.: Decision related with technological transfer



Source: Adapted from Vendrell-Herrero, F. (2009)

Technology transfer offices have to promote entrepreneurship within the university, such as to motivate scientists to produce research and knowledge that might be valuable and to encourage formal disclosure of inventions. Formal technology transfer mechanisms are considered to be the ones that result in legal instruments, as patents or licenses (Siegel, D. et al. 2007). To encourage formal disclosure among academics, universities may need to provide incentives to researchers. Therefore, incentives should be aimed at involving university members in formal technology transfer activities (Siegel, D. et al. 2007) and it seems that institutions that provide scientists with higher

incentives will probably increase the number of projects disclosed and consequently will receive higher license incomes (Lach and Scankerman; 2003)²⁴.

The strategies of the TTO to promote spin-off formation within the university are dependent on the entrepreneurial context of the region and the university. Usually in regions of high level of innovation, the TTO can benefit from a “business pull strategy”, in which spin-offs will be formed without the need of an active promotion from the support service. In environments where high-tech entrepreneurship is less developed, TTO may have to follow a “business push strategy”, proactively searching for opportunities and raising entrepreneurial awareness within the institution.

As a conclusion, it seems essential to provide TTOs with skilled personnel, with appropriate technical skills to develop the universities’ commercialization activities (Siegel, D. et al. 2007). This assumption will lead us to the analysis of the resource-based approach.

2.3.2.2. The resource-based approach

The recent research on how universities can support spin-off formation has been using a resource-based approach, which is sustained by the conception that the universities’ resources and capabilities employed to support the firm formation are the differentiator element and a predictor of the success of the spin-off firm foundation and development (Lockett and Wright, 2005; O’Shea et al., 2005; Rothaermel and Thursby, 2005; Shane and Stuart, 2002)²⁵. The resource-based perspective is one of the most influential perspectives in strategic management research (Barney et al. 2001; Brush et al; 2001²⁶). It assumes that processes can be intentionally coordinated, by an internal construction and that they are not simply the result of adaptation to the external environment. It thus assumes that spin-off creation and its internal organization are a result of a combination of exogenous and endogenous features at the university level (Rasmussen, E. 2009). This theory considers that the type of spin-off created and its process of development are based on organizational and human resources that are put together according to the capacities of the higher education institution and its environment. It has also been used in the spin-off process perspective, assuming that the resources acquired by the spin-off over time were responsible for the changes in its development.

²⁴ Cited by Vendrell-Herrero, F. (2009)

²⁵ Referred by Rasmussen, E. (2009).

²⁶ Cited by Wright M. et al (2007)

Based on prior studies, Wright, M. et al. (2007) apply the resource-based perspective to the study of spin-off formation support. The authors elect six types of resources as being the core of the spin-off process support, which are: organizational, human, technological, physical, financial and social resources. Organizational resources include measures related to the organizational structure of the support unit, its mission, if it is a separate unit from the TTO, and its degree of autonomy within the university. Regarding human resources, the differentiation is made in terms of the size of the team, the different multidisciplinary qualifications, their experience, with special emphasis given to the technical experience of the team members, and the presence of a well-known entrepreneur. Technological resources comprise items such as the existence of specific technological focus in the projects supported, such as excellence centres. Physical resources refer to the space and equipment provided to support the spin-off formation, such as access to offices, incubation facilities and science parks. Financial resources apply to the existence of public funds and its control, public-private partnerships, venture capital companies, incomes from technology transfer commercial activities, and its utilisation to support the spin-off creation projects. Finally, the social resources are considered as the social network developed by the support unit and type of collaborators (public agencies, local industry, business advisers and VC community) and which will be made available to the spin-off team in terms of research opportunity creation, knowledge sharing or investment.

A majority of studies from this perspective, related to academic spin-off creation have been describing the universities reality and the characteristics of the environments facilitating the spin-off creation. These studies have permitted a better understanding of the spin-off phenomenon, identifying the favourable conditions within which spin-offs are created. By linking the resources made available to the type of support given to spin-offs, which is considered to influence the output in terms of the created spin-off, the resource-based theory enables us to understand the type of support offered by a university as a rational choice to attain specific goals. This is the basis of the strategic choice theory.

2.3.2.3. Strategic Choice Theory

As referred above, the strategic choice theory is built on the resource-based theory and assumes that universities have specific goals in terms of the quantity of spin-offs or the

type that they are willing to promote. To attain its objectives the institutions chose to allocate specific resources according to their internal capacity but also considering the specificities of the local and regional environment in which they are embedded.

We are going to analyze the strategic choice theory, based on the strategies of the parent organization, which tries to understand how those choices might influence the spin-offs creation. We will follow the studies of Wright, M. et al. (2007) which present three distinctive organizational models, in terms of the resources used and the activities undertaken, at the level of the parent organization, through incubator²⁷ structures, impacting on the spin-off creation: (1) the low selective model, (2) the supportive model and (3) the incubator model. In this study, the three models are analyzed according to the different dimensions presented above: the activities undertaken and the resources employed.

The activities undertaken by the incubator structure that will be analyzed according to the three identified models, are: the opportunity search and awareness creation; the assessment and protection of intellectual property; the strategic choice on whether and how to commercialize the invention; the business plan development and incubation; the funding process; and the control and follow-up process after the start-up of the company. Respecting the resources, the authors employ the six types of resources, identified and analyzed above (human, social, financial, physical, technological and organizational resources).

The Low Selective Model is oriented to the maximization of the spin-off creation and based on a natural selection process. It adopts a fairly passive strategy regarding the search for opportunities and its mission is rather to create an entrepreneurial awareness among the university's community. The spin-off funding process is usually assumed by public funds. This model needs the lowest quantity of resources, only a small team of people familiarized with the existing government grant programmes and organized in a unit within the university. The mission of this support unit is the promotion of entrepreneurship awareness. The technological resources are dispensable in this model and in terms of physical resources there is no need for specific infrastructures for

²⁷ Here, the concept of incubator is employed by the authors according to the UK Business Incubator definition, which considers incubation as a dynamic activity that undertakes one of the following functions: encouraging faster growth and greater survival rates of start-ups; identifying business opportunities; encouraging commercialization of academic research and knowledge; and promoting jobs and wealth creation at regional level. Therefore we consider that different universities' structures can be included in this definition, such as some entrepreneurial offices or departments, TTO, incubators or science parks, performing some or all of these activities.

business development. The emphasis of this model is on social resources, as the success of this model depends on the existence of an established network with various public agencies and the extensive knowledge of the teaching curriculum of the university, to stimulate an entrepreneurial orientation.

The Supportive Model is engaged in generating spin-offs as the preferred commercialization orientation, instead of licensing the university's IP. This model is not directed to opportunity search neither to entrepreneurial awareness creation in the academic community. This implies the reliance on a high level of disclosure at the university. Incubation and business plan development are the central activities, and the assistance to researchers is high and includes coaching and business advice. The support given by the support services unit is extensive during the pre-start-up phase. Incubation facilities should exist and should include space and access to equipment. The tendency in terms of spin-offs' financial process is to use public-private partnership funds. Regarding the human resources, a multidisciplinary team of at least fifteen people is desirable, with technical backgrounds to engage in patenting activities, and some with business experience. The technological resources in this model tend to be oriented to specific technologies. The TTO sources of financial resources are based on the returns upon economic profitability and on networking with venture capitalists and public agencies. Therefore social resources are critical, and stress the need for a well-established network.

Finally the Incubator Model is analyzed. This model is not oriented specifically towards spin-off creation; rather it is based on the balance between generating contract research versus spinning-off the research in a separate company. This model is perceived as more proactive in addressing opportunity search and awareness creation activities. The decision on the base of the creation of a spin-off is based on financial and strategic arguments, because the main sources of income for the incubator are research contracts. Installations and full support services are provided, like business plan development, recruitment of the managerial team and the composition of their technology platform. The incubation process has a long time horizon, usually taking up to three years to test all the assumptions as the venture is carefully prepared. The human resources are usually composed by a team of 30 experienced people, with interdisciplinary skills. The technological resources are based on centres of excellence. Regarding the physical resources, these spin-offs usually lie near the origin, in the parent laboratory, to be close to the technological assets. This model requires substantial resources, as the creation of

a centre of excellence requires considerable investments. In what concerns the social resources, the authors consider them to be less important in this model, once all the stages of development of the company are effectively supported within the spin-off services which are “self-contained” and “self-sufficient”.

Some authors²⁸ consider universities as loosely coupled institutions (Weick, 1976) which are not following clear strategies and whose managers have a limited role and influence inside the organization (McGuinness and Morgan, 2000). For them, the strategic choice theory is problematic because of its assumptions that university managers are able to choose the right strategy and that it is possible to implement those strategies. But in opposition to this critic of a lack of strategy and decision implementation at universities’ level, the increase in licensing activities in universities has been demonstrated to be the result of the willingness of university administrators (Thursby and Thursby; 2002)²⁹. This implies that even if universities are complex institutions, the willingness is still an important step to implement change. In fact universities are complex structures, with a variety of stakeholders with different expectations, and with a combination of diverse goals and outputs that, in some cases, can be considered opposed (societal utility and non-profit organization versus commercial activities, or open research versus adjustment of research projects to valuable and commercial objectives). However, taking into account Stevenson’s definition of entrepreneurship, we consider that entrepreneurial universities are capable of meeting those different goals and expectations - that can be perceived as opportunities - in a creative and experimental way, adapting to different circumstances and unpredictable occurrences, thus beyond the resources that the university controls. Here lies the reason for the necessity of implementing an entrepreneurial culture inside universities.

As we have been analysing the entrepreneurial activities of a higher education institution, through technology transfer are important because they link the university to the market and the region, and raise the importance of universities at a regional level, as agents of economic growth. Therefore universities have to adapt their structure and culture and engage in a set of activities to promote knowledge and technology transfer, commercialization activities and spin-off creation in their community.

²⁸ In Rasmussen, E. (2009)

²⁹ Cited by Clarysse, B. et al (2007)

In this chapter, we have analyzed the importance of universities entrepreneurship activities, for the purpose of regional development. We have reviewed the different perspectives on entrepreneurship within universities considering their different dimensions: education, transfer of knowledge and knowledge capitalisation. As a conclusion, we affirm that universities have to engage in both these components, of research and education and combine them such as possible, in order to really establish an entrepreneurial culture, motivating students and academics. As a conclusion of this section we will quote Etzkowitz, H. (2008: 37)'s conception of an entrepreneurial university:

“... This means that entrepreneurial training is available to all students. Just as students learn to write a personal essay to express their thoughts, a scientific paper to test hypothesis against evidence, so they should learn to write a business plan to set forth a project to accomplish, a method to reach that goal, and a market test. Furthermore, just as the laboratory is alongside the classroom, so should the incubator facility be part of each academic department, with the incubator – a trainer of organizations – seen as an educational as well as an economic-development arm of the university. The full-fledged entrepreneurial university is a seamless web of teaching, research, and entrepreneurial activities, with each supporting the other.”

On the next chapter we will analyze the situation of academic entrepreneurship in Europe and in Portugal.

3. Entrepreneurship in Europe

We will overview the situation in Europe by focusing on the European policies to foster entrepreneurship in general considering the European Union (EU) entrepreneurial performance, then we will focus on higher education policies and try to understand the overall strengths and weaknesses.

3.1. Entrepreneurship and innovation in Europe

In this section we will present and analyze the situation of entrepreneurship in the European Union, based on the policies implemented during the last ten years in order to foster entrepreneurship.

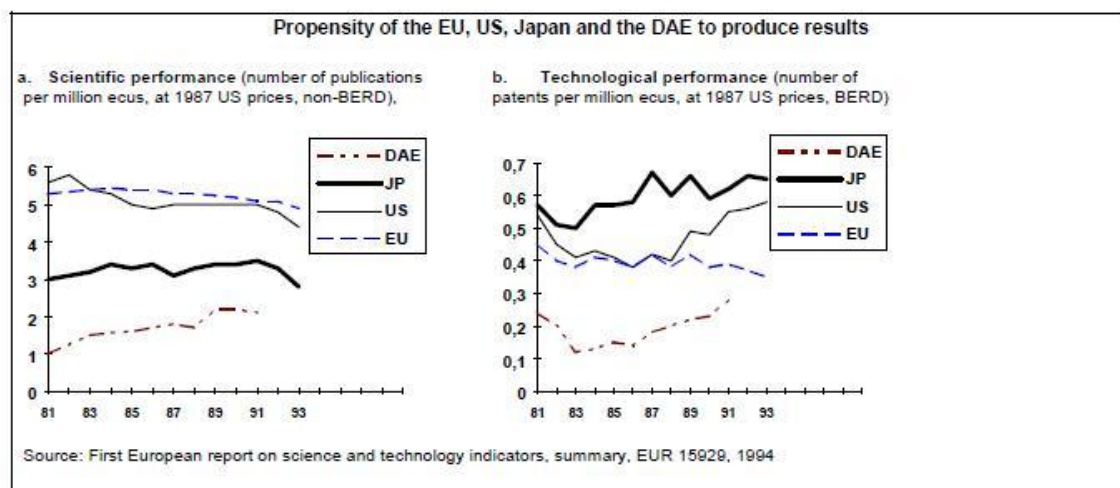
Entrepreneurship in the European policies has been viewed as a basis for innovation, because it is considered that entrepreneurs are the agents of economic growth, with the ability to accelerate the creation, application and dissemination of innovative ideas. Therefore, entrepreneurship promotion is seen as a trigger for innovation, competitiveness and job-creation. The actions undertaken in Entrepreneurship policy are directed to increase the number of entrepreneurs and aiming at mindset change towards openness, flexibility and risk tolerance. Regarding the support mechanisms to promote entrepreneurship, actions are organized to improve the business environment, promote entrepreneurship and facilitate their access to the market.

The interest on entrepreneurship by European policy makers started during the 1990s, when it became clear that it were no longer the large established firms that created more jobs, but instead the new small and fast-growing ones. The contribution of entrepreneurship and innovation to economic growth became evident. The European policy to promote Entrepreneurship has been developed with the objective of creating a favourable environment for “growing” entrepreneurs and promoting business creation and development. Knowledge, innovation and business dynamism are considered the main conditions leading to job creation, sustainable economic growth and social cohesion. As our study is on academic entrepreneurship, we will pay special attention to the role of education and research in the entrepreneurship and innovation policies, as they are supposed to be integrated. We will however focus on the education and research policies for higher education institutions specifically in the next section.

For the European Commission (EC) “Entrepreneurship is the mindset and process to create and develop economic activity by blending risk-taking, creativity and/or innovation with sound management, within a new or an existing organization”³⁰.

Recognizing its unsatisfactory situation in comparison to US and Japan, the European Commission identified the so-called “European Paradox”³¹, a situation in which, despite the EC’s excellent scientific capabilities, measured by the number of scientific research publications, its capacity to exploit this potential and transform it in commercialization, in terms of patents issued, was poor (Figure 3.1). The European Community was losing its competitiveness, when comparing its degree of innovativeness and technological performance to that of the United States and Japan.

Figure 3.1: Propensity on the EU, US, Japan and the DAE to produce results.



Source: Green Paper on Innovation; European Commission; 1995

The analysis of the countries differences evidenced the disparities with the competitors that were exhibiting a greater level of research effort (Table 3.1. Appendix), a higher proportion of scientists and engineers in the active population, a closer relationship between universities and industry, higher and diversified funding of industry and high technology; a culture of risk taking (US) and improvement (Japan), lighter bureaucracies in the US and, in Japan, a close strategy between universities and industry and a great level of staff mobility. European citizens were found to be less entrepreneurial (as for the desire to be self-employed) and more risk-averse³², and it was

³⁰ In: the Green Paper on entrepreneurship in Europe, (2003), 6

³¹ In: the Green Paper on Innovation, (1995)

³² Eurobarometer, 2002: barometer on Entrepreneurship, European Commission

also found that the new European companies were growing at a slower pace than the American and the Japanese ones (Appendix Table 3.1.).

These findings were the base for the European strategy for entrepreneurship and innovation. The authorities were believed to have a key role in the creation of an environment that would encourage more innovation and entrepreneurship in the society. By taking part in the know-how development, its distribution and diffusion, through promoting people's mobility as well as a closer interaction between firms and universities, authorities would contribute to innovation and lasting growth.

Convinced that lasting wealth was based on innovation and knowledge, and confronted with the European reality of an increasing distance from the high performing economic indicators of the United States and Japan, the European Council launched the Lisbon Strategy in 2000, establishing the goal of becoming the world's "most competitive and dynamic knowledge-based economy capable of sustainable economic growth, more and better jobs and greater social cohesion"³³ by 2010. Entrepreneurship was one of the main objectives, as it was the strength of the EU's research capacity, in order to consolidate an innovative economy. To achieve these goals, the strategy was to increase R&D investments up to 3% of GDP, two thirds of which should be funded by the private sector; to relief the barriers to entrepreneurship namely the administrative and financial barriers to start-up a firm; to encourage the raise of information society technologies and to foster the economy and create more jobs as to achieve an employment rate of 70 %. The Lisbon Agenda was an integrated strategy that impacted on different sectors, namely in education and research, creating an opportunity for universities to be at the core of the process as institutions of education and training of the EU citizens, but also as the major research development institutions in Europe.

A series of initiatives were launched to support entrepreneurship implementation. Willing to create "the best possible environment for small business and entrepreneurship (...)"³⁴ the EU identified as first line of action education and training, aiming to create entrepreneurial citizens from an earlier age. Among the different actions that were more directly connected to facilitate business creation and development, the eighth line of action was directed to strengthening the technological capacity of small enterprises by strengthening the technology dissemination and the cooperation between small enterprises and higher education and research institutions.

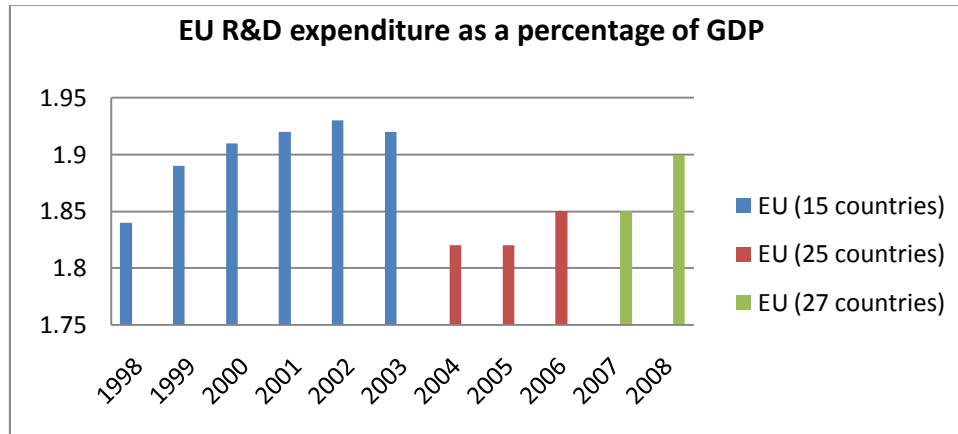
³³ In: European Parliament, presidency Conclusions, Lisbon European Council (2000), 23 and 24 March

³⁴ In: European Charter for Small Enterprises, (2000), 1

A reflection was launched amongst policy makers, experts and different stakeholders on how to promote entrepreneurship in Europe, to create more entrepreneurs as well as how to get more firms to grow faster (The Green Paper on Entrepreneurship in Europe; 2003). This document served as the basis for the further Entrepreneurship Action Plan, The European Agenda for Entrepreneurship (2004). This proposal was based on five strategic action areas: 1. Creating an entrepreneurial mindset through education and training; 2. Encouraging firms creation by risk reducing, working at the legislation, tax and social security levels; 3. Helping firms growth and competitiveness by providing training, specially to women and ethnic minorities, as well as a supportive network; 4. Providing more and better access to finance; 5. and finally reducing the administrative and regulatory framework.

However, EU faced an economic slowdown and suffered its biggest enlargement in 2004 that impacted hardly on the economic progression towards a competitive knowledge-based economy, slowing down the progression towards such ambitious goals (Figure 3. 2).

Figure 3.2.: EU’s Research and Development Expenditure as a percentage of GDP



Source: Based on data from Eurostat – Appendix Table 3.2.

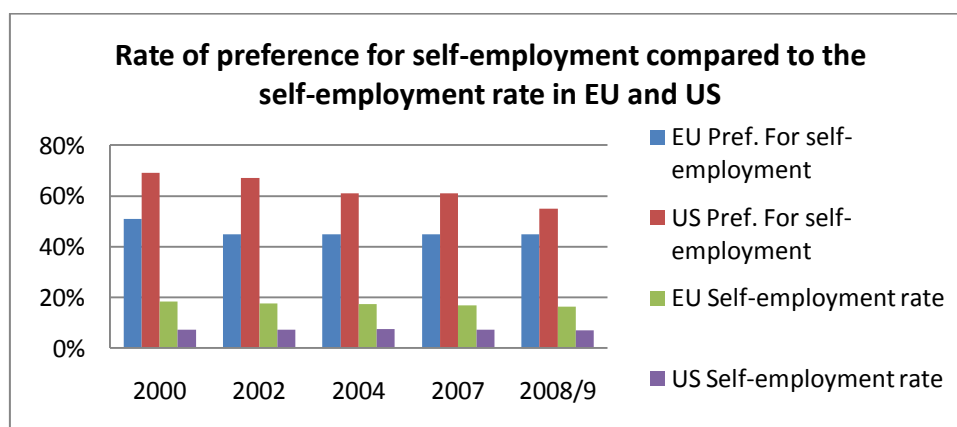
The role of education in creating more entrepreneurs and its contribution to the Lisbon goals has already been demonstrated. However, only in 2006, the European Action plan for entrepreneurship education³⁵ was launched. Despite the recognition of the Higher education institutions’ problems, the Commission’s recommendations to foster

³⁵ In: Implementing the Community Lisbon Programme: Fostering entrepreneurial mindsets through education and learning (2006)

entrepreneurship in HEI are rather limited, which may be due to the high level of decentralisation of tertiary education. Its major concern relates to the integration of entrepreneurship across the different degrees, but mostly in scientific and technological studies. The action proposed for Public authorities relates to support high-level training for teachers, their mobility between university and companies as well as to networks development.

During the timeframe of the Lisbon Agenda, most EU countries improved their entrepreneurial conditions by lowering the barriers to entrepreneurship. A decrease of almost one point between 1998 and 2008 in a scale from 0 (least restrictive) to 6 (most restrictive)³⁶ was achieved, but it had no impact on the promotion of entrepreneurship, measured by both the willingness for being self-employed and by the proportion of self-employed in the active population. In fact these indicators have not progressed, but instead they have stagnated (Figure 3.3.).

Figure 3.3.: Rate of preference for self-employment compared to the self-employment rate in EU and US



Source: data from OECD Factbook 2010 (Self-employment rate) and Eurobarometer on entrepreneurship (preference for self-employment) – Appendix Table 3.3.

In the Strategic report on the “renewed Lisbon strategy for growth and jobs: launching the new cycle (2008-2010) Keeping up the pace of change” (2007), the results of the European Union were considered to be well progressing, and the structural reforms that were being implemented within the Lisbon strategy were believed to be finally established. In progressing areas the goals were re-conducted, however, others such as

³⁶ In: Measuring Entrepreneurship, A collection of Indicators, Edition 2009, OECD – Eurostat Entrepreneurship Indicators Programme: <http://www.oecd.org/dataoecd/43/50/44068449.pdf>

higher education and training, knowledge and innovation still needed further improvement.

By now the strategies are already oriented towards the 2020 goals. R&D expenditure is still below 2% with low levels of private investment³⁷ participation, and the EU still lags behind the US (2,6%) and Japan (3,4%). Entrepreneurship and innovation remain at the core of the European concerns, and universities maintaining a core position. Three priorities have been stated: the development of an economy based on knowledge and innovation; the promotion of a more resource efficient and competitive economy; and the fostering of a high-employment economy providing territorial and social-cohesion. This time the appeal launched for a coordinated European response, also calls for the intervention of the social partners and the civil society.

As we have seen, entrepreneurship has been acknowledged as one of the main goals for Europe during the last decade, and it will surely remain at the core of the European policies for the next one. Education and research are crucial role players in the entrepreneurship policy. Education and training frequently appear as the first route of action in most of the strategies to implement an entrepreneurial economy. There is a need to implementing changes at the level of mindsets, creating creative, responsible, confident and risk-taking citizens. We will now analyze how these goals have been translated into policies at the level of higher education.

3.2. Entrepreneurship in higher education in Europe

As we have seen, the Lisbon Strategy has put entrepreneurship at the core of EU preoccupations in order to achieve the goal of the knowledge-based economy. Two of the key policy means to achieve it are education (including training) and research, which are the core missions of universities. Therefore universities are in a prominent position to be the motor of change to an entrepreneurial Europe. But are universities prepared to embody this mission? Can the European universities be the entrepreneurial academies needed to achieve this mission? As the reform of Education training and research are wide, we will concentrate on the important aspects for the development entrepreneurship in universities.

³⁷ Europe 2020: A Strategy for smart, inclusive and sustainable growth, Communication from the Commission; 3.3.2010

European universities are recognized to produce high quality scientific publications. However they have less to offer and lower financial resources than their United States competitors. European universities employ 34% of the total number of researchers and are responsible for 80% of the fundamental research developed in Europe. In terms of education, they train an increasing number of students (over 12, 5 million in 2000) in increasingly high-qualifications.

In 2000 universities were not in conditions to undertake this mission. Therefore a strategy was needed in order to modernize the European Higher Education system and to make it globally more competitive. The possible advances of the education and training policy were viewed as having a decisive contribution to the success of the Lisbon Strategy³⁸. Three main objectives were set: Improving the quality and effectiveness of education and training systems; facilitating the access of all to education and training systems; opening-up education and training to a wider world. In the education and training policy, entrepreneurship is identified as one of the key competencies that should be developed in European citizens. The actions proposed for the education and training policy are related to the development of entrepreneurial educational institutions, focusing on the promotion of scientific and technological studies as well as the spread of business and management knowledge at all levels and in all educational areas. As a response to the shortage of qualified personnel in these areas, which are considered essential in a society of knowledge and innovation, the actions proposed aim at increasing the number of scientists and technological graduates, as well as researchers. In what refers to the spread of entrepreneurship knowledge, the strategies aim at: (1) strengthening the links between educational institutions and working life as well as research and society at large; (2) developing the spirit of enterprise by promoting the values of enterprises; (3) spreading models of successful entrepreneurship; (4) promoting risk taking and sense of initiative; (5) promoting education for entrepreneurship and self-employment. These lines of action are aimed at empowering the researchers' work-force in numbers, and complementing them with entrepreneurship education to increase the potential of an innovative and knowledge-based society.

In 2003, the European Commission issued a Communication on “The role of the universities in the Europe of knowledge”, aiming at introducing the reflection and the

³⁸ In: Education Council in cooperation with the Commission, February 2002.

debate on these institutions that were out of the focus of the Union for a while. There are near 4000 universities in Europe (EU and candidate countries), organized at national and regional levels, very heterogenic, but working towards some coherence and compatibility within the Bologna Process' reforms. For a long time these institutions were following the traditional Humboldt model, but recently we are watching the emergence of specialised institutions in specific domain of competences or in particular dimensions of activities.

As previously referred in 2006, the European Action plan for entrepreneurship education was launched. The EU recommends the implementation of entrepreneurship education at all levels, to create creative and entrepreneurial citizens. Concerning universities the challenges are: “to integrate entrepreneurship as an important part of the curriculum, spread across different subjects” and “combining entrepreneurial mindsets and competence with excellence in scientific and technical studies to enable students and researchers to better commercialize their ideas and new technologies developed”. (Communication from the Commission, 2006: 9) Regarding the latter challenge, the importance of incubators, science parks and spin-offs is stressed and the necessity of having students and scientists prepared with business and managerial competences and a supportive environment within the university is outlined. The problem of the academic career system, discouraging academics to take an entrepreneurial path, is acknowledged as are the labour mobility and the lack of recruitment flexibility, constituting barriers to entrepreneurial universities. Following this communication, a conference was held in Oslo (2006), entitled "Entrepreneurship education in Europe - fostering entrepreneurial mindsets through education and learning", gathering the different stakeholders, representatives from European educational institutions and experts, to work on ways to put the Commission's recommendations into practice.

However the existing support at the level of the European Commission directed to universities is not directly oriented to entrepreneurship. Concerning research support, under the Framework Programme or with the support of the Structural plan or the European Investment Bank, there are some actions directed to universities, which relate to technological innovation, aiming at the use of research and development results achieved in science parks.

The reforms implemented at Higher Education level, following the implementation of the Bologna reform have enabled the universities to open to a wider world, including an

adult world, with working experience, and ultimately it has consisted in flows of knowledge from the market to universities and the other way around.

We consider that there have been good progresses at the Education policy level towards the Lisbon goals. Despite the recognition that universities are acting at the level of education and research, most of the strategies and recommendations towards an entrepreneurial academy are at the level of education. The fact that, at the Commission level, there are separated General Directorates for Education and Training and for Research is indicative of this separation. There is a lack of a comprehensive policy to universities as a whole that we believe to be reflected at the Member States level, and at institutions level.

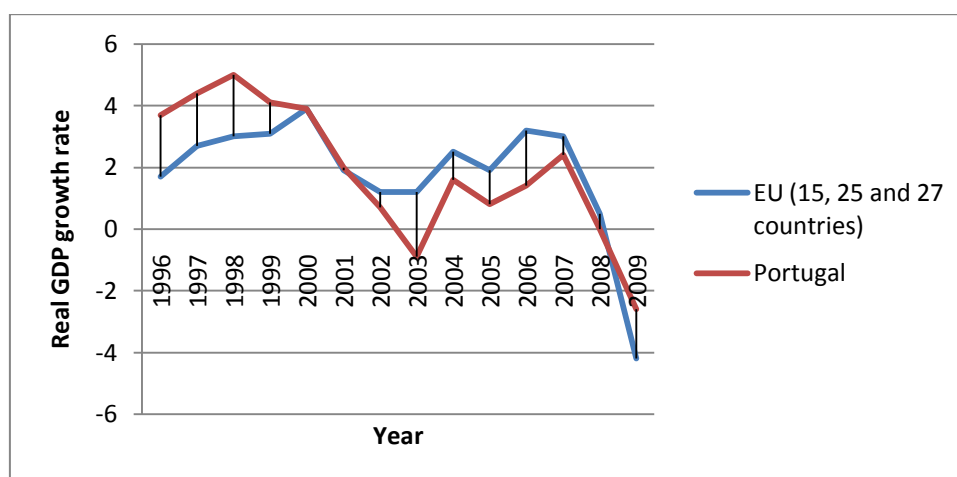
4. Entrepreneurship in Portugal

In this section we will overview the entrepreneurship situation in Portugal. We will start by analyzing the Portuguese reality in terms of entrepreneurship indicators, we will then focus on the Portuguese policy towards entrepreneurship, and we will end this section with the analysis of the Portuguese higher education reality.

4.1. The Portuguese economic and entrepreneurial performance

In terms of economy, Portugal has had an impressive recovery to the more advanced economies after entering the European Community. However, in the last decade this performance has slowed down, as revealed by the decrease of the growth rate of its GDP, to negative values with the actual crises, as shown in figure 4.1.

Figure 4.1.: Evolution of real GDP growth rate in Portugal and EU



Source: Eurostat – Appendix Table 4.1.

The deterioration of the Portuguese performance has been influenced by the changes of economical and social contexts, which have been moving towards a specialized technological based economy. Portugal has been having problems to adapt, because of its concentration on sectors of low and medium technological intensity.

Portugal has been exhibiting constant low rates of productivity in terms of GDP per capita, below the average performance of the European Union for the last 15 years. With the globalisation context of the economy, and the economic crises, Portugal is losing competitiveness within the EU and at global level. Important investment efforts

have been made however they did not effectively result in increased productivity, improved qualifications, educational results, innovation or intellectual property rights. Despite the increase in the number of high technological firms in Portugal, in 2005, they still represent an extremely small share of enterprises in the Portuguese market (1,8% in 2007, Appendix Table 4.2.).

Entrepreneurship is therefore of primary concern for Portuguese recovery. However, when analyzing the entrepreneurship indicators, we came to the conclusion that there is much to do.

Despite the fact that, compared to the EU, Portugal was the country which expressed the greatest desire for self-employment³⁹, 62% of the inquiries would prefer to be self-employed considering the different forms of employment. When it comes to actually taking the initiative to start their own businesses, Portugal is below the average of European countries, with only 14% of inquiries having started their own business. The entrepreneurial dynamic is very low in Portugal, at the bottom of the EU and of the GEM analyzed countries. Most of the start-up businesses in Portugal are in the sector of consumption, and very few are introducing new products in the market or creating any type of innovation.

Portuguese entrepreneurs, during the first years of 2000, had the highest EU rate when confronted with the motivation for starting their business, with 42% of respondents of the Entrepreneurship survey in EU, evoking necessity reasons, considering that the reasons appointed for start-up are economic or income-related factors. This data is very relative, as in the same year the Global Entrepreneurship Monitor (GEM) reported that entrepreneurship for necessity in Portugal was below 20%. However, what is interesting to analyze in the European surveys, is the greater comparability between years, as compared to the GEM Reports, in which Portugal has only participated in three surveys. In terms of comparisons between the European surveys, it is interesting to notice that there has been an improvement in favour of the opportunity factor. In fact from 2007 on, only 25% of the respondents evoke necessity reasons for starting their business, with a majority of respondents, 50% starting a business because they saw an opportunity⁴⁰. According to the Eurobarometer this is explained by an important entrance of young entrepreneurs that usually start a business by opportunism, and not as a consequence of an economic improvement.

³⁹ GEM – Global report on entrepreneurship, 2001

⁴⁰ Flash Eurobarometer, Entrepreneurship Survey n.º 160, 2004; n.º 192, 2007; n.º 283; 2009

The barriers to entrepreneurship are related to red-tape, lack of financial support, lack of education and training towards entrepreneurship, low level of qualifications, risk-aversion, cultural barriers (stigma of failure), and lack of management capacities of the existing employers. According to the GEM National Report 2001, the first line of action to develop entrepreneurship conditions in Portugal should be at the educational and training level.

According to different studies, (GEM Global Report on Entrepreneurship, (2001 and 2004), Flash Eurobarometer on Entrepreneurship, (2008); Godinho, M. and V. Simões (2005)), the areas identified as problematic in Portugal, concerning entrepreneurship performance and development are:

Financial Support: Lack of access to all kinds of capital. The banks are at the centre of the Portuguese financial system which is based on credit (loans), which is risk averse. The stock exchange market is limited, and without capacity of stimulating initiative or innovation. Private risk capital firms in Portugal are few and traditionally they do not invest in innovative projects, despite the existing support to some projects with high level of risk. Regarding business angels, the lack of legislation of their activity has also limited their role. The good practices are however found at the level of mutual guarantees and credits securitisation that have permitted the stabilization of SME finances.

Government policies: Public policy is needed to create a favourable environment for entrepreneurship. Some areas have been highlighted as not contributing to this environment, such as employment regulations that are too strict for start-up firms' capacity of guarantee, the level of bureaucracies (in 2001). The existing government programmes, which are not coordinated towards common objectives and that are not directed to start-up phases.

Education and training: The problems are the level of instruction and contents. There is a lack of programmes of education for entrepreneurship, and a lack of training for teachers and for entrepreneurs. It is interesting to note that Portuguese have the second highest rate in the European context, considering the benefits and influence that education has in developing an entrepreneurial attitude (71%)⁴¹. Not less interesting is the fact that Portuguese also have the highest rate of respondents in the EU who abandoned school before the age of sixteen (37%).

⁴¹ Flash Eurobarometer on Entrepreneurship n.º 192, 2008.

Research and Development: The lack of financial support for research and development has been highlighted, as well as the lack of investment in technological and research firms. The transfer of technology and knowledge is not effective, as the search for results is not promoted, impeding to take full advantage of the developed technology.

Commercial and Professional Infrastructures: The limited competitiveness in these areas has resulted in a lack of quality and improvements. The need for high qualified personnel is stressed.

Internal Market Openness: The dominance of existing companies and the presence of state-owned or state-sanctioned monopolies have impacted on the possibilities for new entrants.

Access to Physical Infrastructures: Again the problem of services, that are costly, slow and hard to access, like transport and communication, and which may impact negatively on start-up firms.

Cultural and Social Norms: Even if entrepreneurship is socially acceptable, the Portuguese overriding attitude is of risk aversion, and failure stigmatization. The problematic of education is again referred as the Portuguese lack the skills to manage business resources.

Protection of Intellectual property rights: It reveals some inadequacies. Legislation is insufficient and insufficiently enforced.

4.2. Portuguese entrepreneurship policy

As well as in the EU, Portuguese entrepreneurship policy is integrated with the innovation policy. However, Portugal has been experiencing a lack of integration and coherence in its innovation policy, looking at science and technology distinctively from innovation, organized in different Operational Programmes, associated to different and specific ministries, obstructing the application of a transverse policy of innovation.

For a long time policies for science and technology and the innovation policy, used to occur within the Operational Programme for Science Technology and Innovation, under the Community Support Framework. Science and Technology have been developed under the Ministry of Science and Technology, apart from the innovation policy, which was developed under the Ministry of Economy and Innovation, the Operational Programme for Enterprises. The subjacent idea was that the investments in science

would lead to innovation. If the results of the science policy had positive issues, such as the increased number of researchers, of PhD holders, and of scientific publications, the performance of the technology and innovation policies was modest, with limited private investment in R&D, poor absorption of doctors and masters holders by firms and reduced intensity of patents. The linear structure of organization of these two policies was a subject of criticism, as it was considered contrary to their cohesive development⁴². Another critic to the policy of innovation was that it was too affected by the changes in governments.

In 2005, the critics appointed were acknowledged and a “Technological Plan” was launched, as a strategy for fostering the development and competitiveness of Portugal, acting in a transversal mode, and based on three lines of actions: (1) knowledge, as to increase the qualifications of the Portuguese for the knowledge society; (2) technology, as a way to recover from the scientific and technological backward; and (3) innovation, as a way to inculcate a new impulse to innovation. This instrument materialized the alignment into a coherent policy of R&D, innovation, and entrepreneurship. The Plan follows the line of the “open method of coordination” implemented with the Lisbon Strategy, and implements a method of definition of crucial indicators to monitor the achievement of the designed goals and strategies.

We will enunciate the plan’s objectives and measures, concerning the three priorities of action identified above. There are so many and so diversified lines of actions that we won’t analyze the specific initiatives which have been implemented. We will rather attempt to give an idea of the Plan’s implementation and the coverage of the above identified areas, as a response to the lack of Portuguese competitiveness and low performance in terms of entrepreneurship and innovation:

Knowledge: (1) the objective of increasing the qualifications of the Portuguese and promoting Lifelong Learning are aiming at fostering a qualified Portuguese work force. For this purpose, the measures consist in the generalisation of secondary education for young and for adults, by limiting school abandon and fostering professional secondary education, and by giving the opportunity to adults in working-life to complete their education, by increasing education designed for specific publics, promoting the recognition, validation and certification of competences. Regarding higher education, the objectives are to increase the share of graduates in general and in

⁴² Godinho, M. and Simões, V. (2005)

particular science and technology graduates; to reform the system according to the Bologna Process, and to promote its quality. Regarding entrepreneurship, the inclusion of it at all levels of education and in what concerns secondary and higher education, learning by doing is developed by the promotion of small firms managing and business plan competitions. (2) The second objective of this line of action is to mobilize the Portuguese for the information and knowledge society, by the creation of an inclusive information society with the generalization of the use of information and communication technologies. The measures consist in increasing the Internet utilization by creating the needed infrastructures in order to promote their use by citizens, by students, and by the workforce. This measure is strongly based on the modernization of public administration.

Technology: the main objectives of this line of action are to foster the competencies in science and technology and to promote the awareness in enterprises for research and development. In order to accelerate the scientific and technological development and the creation of qualified job places in R&D and enterprises, the measures consist in increasing the number of researchers, specifically in the technological field, by the creation of scientific and technological jobs in state and private companies. Another important objective consists in increasing the investments in R&D, from public, but mostly from private funds, through financial incentives for private R&D, the incorporation of R&D in investments in projects of public interest, and by favouring the implementation of private-public partnerships.

Innovation: The third line of action of the plan is based on the assumption that enterprises are at the centre of the innovation process, and that there is a need for adaptation of Portuguese enterprises to innovation. This adaptation process is dependent on the quality of institutions and of the economic policy. The objective is to foster the national system of innovation, directed to knowledge production, transmission and adaptation by economic agents. This line of action needs the mobilization of the different actors for a national strategy. The measures for promoting qualified entrepreneurship consist in supporting the creation and start-up of firms in identified priority areas.

The Technological Plan is considered to be helping the state in a transverse mode to create a favourable environment for growth, by facilitating the relation between citizens, economic actors and the government; promoting the flourishing of regional spillovers; facilitating the access to finance for start-up and SME. It is thought as an instrument for

the promotion of an entrepreneurial climate. The question that arises is to which point will it be successful to meet such numerous and diverse goals (78 measures at its starting point in 2005) at the same time, and to what point will these achievements result in effective growth.

The analysis of recent data may reveal that some progress has effectively been attained, but since the economic crisis arose, it is difficult to identify any results in terms of economic growth. The Plan has also suffered some alterations, with the inclusion of nearly a hundred new measures.

To assess the results of the Portuguese policies in creating a favourable environment to entrepreneurship and innovation, we will analyze the Technological Plan indicators' attainment.

According to the 2009 Report on the Progress of the Technological Plan⁴³, Portugal is progressing well in order to achieve the established goals as an innovative society. The education levels of the Portuguese have been enhanced with a greater proportion of population detaining secondary studies, of graduates including in areas of science and technology (this last indicator overpasses the EU average in nearly 5% points). Regarding the promotion of lifelong learning, the participation of the Portuguese increased slightly. Concerning the mobilisation of the Portuguese to the knowledge and information society, there were great improvements in Internet users and availability, even though these indicators remain below the European average. However in what concerns the offer of on-line public services Portugal has attained a share of 90% of available services in 2007, largely over passing the European average of 59%. In what refers to the reinforcement of science and technological competencies, a general recovery towards the European average is recognized, with close results in the number of researchers in the active population and of PhD in science and technology. However in what concerns the share of the active population working in R&D as well as the public and private investment in R&D, the values remain far from the European values, despite their progresses. Finally, regarding the innovation line of action, the indicators have not significantly improved, most of them having stagnated or even declined. The proportion of workers in activities related to high-technology intensity has slightly improved (in the range of 0,12 %), and the exports, value-added and firm creation in high-tech have declined. The only improvements attained were at the level of European

⁴³ Concelho Consultivo do Plano Tecnológico (2009), Relatório de Progresso

patents, but still remaining at much inferior levels than the EU average. As to the registration of European trade marks, the indicators were close to the average ones in the EU.

Despite a general improvement in the conditions to create a more favourable environment to entrepreneurship and innovation, the results in terms of effective performance towards innovation are worrying, with levels of poor performance even before the 2008 global crisis.

In what concerns international reports at European and global level, the position of Portugal remains modest. One of the indicators generally used in these studies is the barriers to entrepreneurship that measures the regulations pertaining to entrepreneurship, combining different indicators such as the regulatory and administrative opacity, administrative barriers to start-up and barriers to competition. Portugal improved one point in reducing entrepreneurship barriers from 1998 (2,16) to 2008 (1,17) in a scale from 0 to 6, where 0 refers to the least restrictive⁴⁴. Regarding the opposite indicator on the ease of doing business⁴⁵, Portuguese results are not so positive, with a rank of 48, in which 1 is the highest rank (until 183). Portugal is positioned near the Eastern European countries, being the United Kingdom (5), Ireland (7) and Norway (10) the better positioned countries of the EU. Despite these improvements on the conditions to create new business, when it comes to the desire of being self-employed, the Portuguese desire for entrepreneurship is decreasing (-20 points than in 2002), but it still remains superior to the preference of being an employee (39%). However when respondents had to consider the feasibility of becoming self-employed, only 18% agreed that it was possible, and only 4% were actually considering starting-up a business. The combination of two factors may explain this decline: (1) the country's economic context, which is not offering favourable conditions for firms' creation and development; (2) the Portuguese cultural risk aversion, inhibiting initiative taking. In fact one of the greatest fears appointed if they were to start a business, is the fear of going bankrupt (53%).

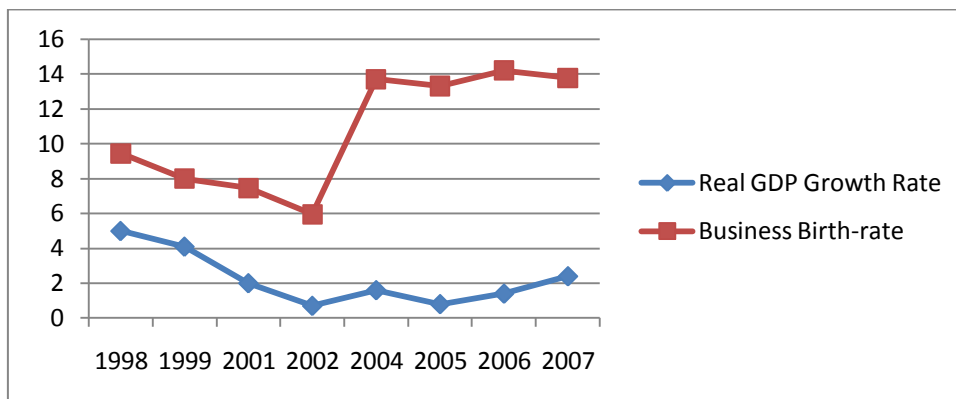
These results are in line with the comparison of the evolution of the real GDP growth rate and the business birth-rate in Portugal (Figure 4.2., below), where we can assess the

⁴⁴ Source: OECD (2009)

⁴⁵ The indicator "ease of doing business" is used by the World Bank and ranks the average percentile of a country on ten topics from starting a business, to the access to physical infrastructures, employment regulations, protection of industrial property, access to finance, protecting investors, fiscal incentives, market openness, enforcing contracts, closing a business.

similar evolution of the two indicators, suggesting a direct relation between the two variables. Of course the raise in the enterprises birth-rate, much superior to the growth of GDP from 2002 to 2004, may be indicative of effective results from efforts made towards the promotion of entrepreneurship.

Figure 4.2.: Real GDP growth rate in Portugal, compared to the enterprise birth rate

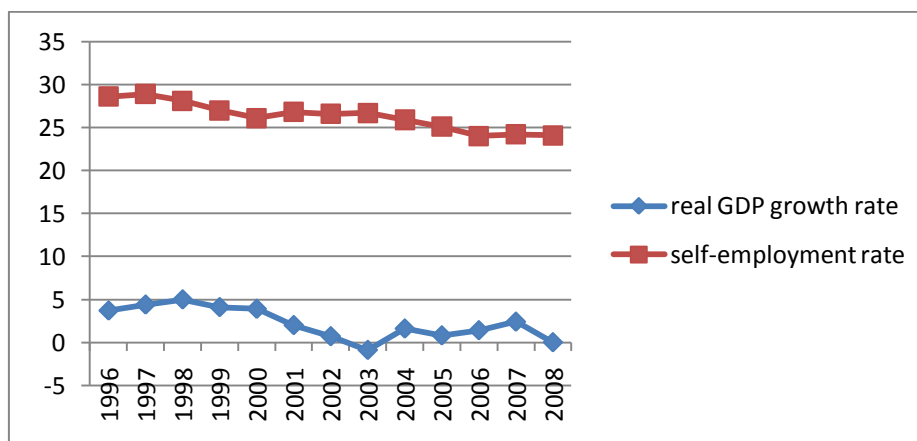


Source: Eurostat – Appendix – Table 4.3.

Note: There were no data available for business birth rate in Portugal in 2000 and in 2003, neither data on total enterprises active for these years that would have enabled to do the calculations, so we eliminated those years.

Regarding the comparison between the GDP growth rate and the self-employment rate (Figure 4.3., below), there is a continuous decrease in self-employment since the GDP growth rate is decreasing and unstable. Considering the Portuguese risk aversion, it is probable that an unstable GDP growth rate is having some impact on self-employment rate.

Figure 4.3.: Real GDP growth rate in Portugal compared to self-employment rate



Source: Eurostat and OECD 2010 Factbook – Appendix Table 4.4.

The overall conditions of entrepreneurship in Portugal have improved, but as the economic climate is depreciative and unstable, the investments made to create a favourable entrepreneurial environment remain unsuccessful. There is a need to stabilise the Portuguese economy as to regain the confidence of the Portuguese and to enable entrepreneurship development and its evolution towards an innovative society.

4.3. Higher Education in Portugal

In Portugal, there are nearly one hundred and eighty institutions delivering higher education. It is difficult to identify the correct number regarding the diversity of situations in the private sector. But in what regards public institutions, there are fifteen public universities, one of which is of distance learning, four military institutions, thirty seven polytechnic schools, two polytechnic military schools. There is one catholic university, with nationally spread poles. In what regards the private higher education there are fourteen private universities and one hundred and five private and corporative institutions⁴⁶. Despite of the existence of one of the oldest European universities (*Universidade de Coimbra*, 1290), the majority of higher education institutions are very recent, being created from the 60s on. In a study on the higher education institutions network in Europe, Crespo, V. (2006) made a comparison between the number of higher education institutions in the different EU Member States, and the countries' population. Considering the total number of higher education institutions, Portugal has 17,45 institutions per million inhabitant, a number that totally exceeds the countries with comparable population, in which the average number of institutions is near 6 per million inhabitant. The weight of the private sector of higher education is particularly high in Portugal. The excessive number of higher education institutions is particularly evident, after having shown that Portugal has a low demand for higher education, in comparison to the EU countries. This situation reflects on the multiplication of scientific areas between institutions, and sometimes also within the institutions.

Concerning the subsector of public universities, which is the core of our study, most universities are located in the North and Centre regions of Portugal, with five universities in Lisbon, only two universities bellow Lisbon, and two others in the archipelagos.

⁴⁶ Crespo, V. (2006)

Regarding the funding of the universities public sector it is predominantly based on the number of registered students, disregarding the quality of the institutions. Following an equalitarian governance system, avoiding greater levels of concentration on fields of specialization, the development of Excellency poles has been made difficult. As in recent years the increase in the demand of students has slowed down, (from 400.831 registered students in 2002/2003 to 376.917 in 2007/2008)⁴⁷, it is crucial to implement alternative sources of income for universities.

In Portugal, the higher education sector is the major employer of R&D personnel, employing 44,5% of total R&D personnel, which combined with the employed by the government leads to almost 55%⁴⁸.

The emergence of entrepreneurship education courses in Portuguese universities is very recent. Only in 2002 or later have the majority of these courses started. According to Redford, D. (2008), who developed a study on the existence and realization of these courses, only a small minority of students have access to it during their undergraduate and graduate studies. The importance of developing PhD courses in entrepreneurship is enhanced as a means to qualify human resources for teaching activities and for the future expansion of these courses and degrees. The study also revealed that in Portuguese higher education institutions, entrepreneurship was still very much related to management departments and to business schools, presented as the major source of human resources that lectured it. In chapter 6 we will analyze the existence of these courses and degrees in the Portuguese public universities.

After a revalorization of the Portuguese higher education made by the OECD in 2006, Portugal has recently passed through an important reform that has created the basis for the complete development of entrepreneurial universities, through all its dimensions. The reform made was applauded by the OECD, considering that action had been taken in most of the appointed areas that had been subject to recommendations.

Entrepreneurship was introduced in the educative legislation in 2005, where the purpose and objective of higher education has been stated: “To stimulate cultural creation and the development of a scientific and entrepreneurial spirit (...)”⁴⁹. The transfer of knowledge and science, and the commitment to the societal and economic development, were introduced as HEI purposes by the Act on the Juridical Regime of Higher

⁴⁷ Source: INE, Alunos inscritos (N.º) em estabelecimentos de ensino superior por Sexo e Tipo de subsistemas; Anual

⁴⁸ Source: EUROSTAT, Total R&D Personnel and researchers by sector of performance, 2007

⁴⁹ Lei n.º 49/2005

Education Institutions, (2007)⁵⁰. In 2009, the legislation of academic careers has been reviewed, aiming at contributing effectively to scientific development of Portugal. Scientific research has been positioned at the core of the academic career and the participation in activities of “academic extension, scientific dissemination and of economic and social valorisation of knowledge”⁵¹ were established as academics’ functions, and taken into consideration in their valorisation.

Regarding the conditions for knowledge and technology transfer, the government supported different initiatives that were implemented at the universities’ level. First, in 2001, a programme for the creation of offices to support the promotion of Industrial Property (GAPI) was launched, and 22 offices were created within a variety of institutions (business unions, technologic centres and universities), ten of which in universities. Then, in 2005 the government supported the establishment of Knowledge and Technology Transfer Offices (OTIC) at higher education institutions (public universities and polytechnic institutions), aiming at creating mediator entities that would support and promote knowledge transfer to the business market. These two projects complemented each other, working towards the promotion and valorisation of intellectual property. On a study about the activities of both of these structures at the academic level, which was done near the OTIC’s project closure, Godinho, M. et al. (2008) evidenced that despite the concentration on their core missions activities, demonstrating higher level of results in their area, both structures appeared to be clearly engaged in patent activities, technology transfer through licensing contracts and the creation of technology based firms, but also in training activities, issuing studies, participating in international networks, associations, fairs and exhibitions. The major difficulties appointed by the structures were the lack of financial and human resources. This study was done in 2008, before the end of the financing cycle of the OTIC project, and at the time the further maintenance of the projects by the universities was uncertain. The projects that were more likely to continue were the ones in which a structural project existed (for one third of the GAPI, one half of OTIC and all the integrated projects), enabling their continuity, funded by the parent university and their commercial activities.

Recently (2006/2007), the government promoted the establishment of a partnership programme, bringing together Portuguese universities and American leading

⁵⁰ Lei n.º 62/2007

⁵¹ Decreto-Lei n.º 205/2009, Articles 4º c), and 74º A, 2, b)

universities (Massachusetts Institute for Technology - MIT, University of Texas in Austin - UT-AUSTIN; Carnegie Mellon University - CMU) in areas related to management, and aiming at fostering science and technology development and entrepreneurship. The creation of several Master and Doctoral programmes in those areas, the promotion of students' mobility within the programmes, but also the empowerment of the Portuguese scientific and technological critical mass, entrepreneurial awareness and network promotion⁵² are being developed. Regarding entrepreneurship of a specific PhD programme in entrepreneurship and technological change (Carnegie Mellon University), the launching of the University Technology Enterprise Network (UT-Austin) aimed at strengthening technology transfer and staff training. The multiplication of seminars on entrepreneurship and the recent creation of technological innovation awards (ISCTE-MIT) are also on track.

The effort that has been made to foster the higher education in Portugal, evolving towards scientific and technology based entrepreneurship is manifest and according to Redford, D. (2008: 62) “Higher education in Portugal has come a long way and it is proven to be evolving in a very effective and positive manner.” Now it will depend on the universities and their staff to effectively implement and commit to entrepreneurship.

⁵² In: Gago, M. (2007)

5. Research Methodology

Our intention in this study is to analyze the degree to which Portuguese public universities are entrepreneurial academies. In the following sections we will present the methodology of our study, as well as its limitations.

5.1. Indicators of an entrepreneurial university

In what regards the research methodology, it aims at measuring the entrepreneurship support and promotion in the public Portuguese universities. We will follow a descriptive perspective for this study, to serve our intention of identifying entrepreneurship practices and structures at universities. To this end we will be using mainly qualitative data, however in section 6.1.2., we will also use quantitative data.

Our study will be based on the analysis of information gathered on the institutional WebPages of the universities. A series of indicators will be drawn to assess the entrepreneurial performance of the Portuguese public universities. The indicators have been constructed according to the bibliographic review that was done in the second chapter. Moreover, we have interviewed professionals of technology transfer and entrepreneurship promotion offices of some of the analyzed universities, in order to validate our study. The interviews were performed by e-mail, to all the Portuguese universities that we intended to analyze. They were composed by 7 to 9 open questions and the intention was to collect the professionals' point of view on the components of entrepreneurial universities, their importance and objectives as well as on the eventual existence of obstacles and the role of the Government. We have received three responses: DITS – *Universidade de Coimbra*; UPIN – *Universidade do Porto* and CRIA – *Universidade do Algarve*. We have also made a direct interview with the coordinator of UL INOVAR, from *Universidade de Lisboa*.

We have participated in an entrepreneurship seminar on “Innovation and Entrepreneurship in Universities”, organized by Ciencinvest on May 24th, 2010 at *Instituto Superior de Agronomia of Universidade Técnica de Lisboa*. This seminar was an occasion to collect and validate useful data for our analysis. The seminar was presented by the following universities, which are also part of our study: *Universidade de Aveiro, Universidade de Coimbra, Universidade de Lisboa, Universidade do Minho,*

Universidade Nova de Lisboa, Universidade do Porto and Universidade Técnica de Lisboa.

We have also participated in two classes of the Interdisciplinary Entrepreneurship Program for Master and PhD students, organized by UL INOVAR from *Universidade de Lisboa*, in order to have a real practical experience on entrepreneurship education.

Based on what has been studied and confirmed by the interviews, universities' entrepreneurship is composed of two dimensions: a dimension of education and training, and another of knowledge and technology exploitation. Our units of analysis will therefore be the university on one side, the education programmes on another and finally the entrepreneurship and technology transfer support offices.

We therefore consider an “entrepreneurial university”, a HEI that combines entrepreneurship education and training with effective knowledge and technology transfer to the society, a campus with dynamic entrepreneurial activities and effective collaborations and links to the industry, the market and the society.

5.1.1. The University

Our intention in the university unit of analysis was to identify the foundations of universities' entrepreneurship.

As viewed previously, the universities' commitment to a third mission (Wright et al., 2007; Etzkowitz, 2008; Goddart and Chatterpon, 2003), beyond the traditional missions of teaching and research, has been serving entrepreneurship purposes. According to European policies orientation, universities should clearly identify the part that innovation and knowledge transfer plays within their overall mission⁵³. Accordingly we have examined the statutes and boards of the universities, in order to detect the commitment to a third mission and, ultimately to entrepreneurship. As mentioned above, we have used qualitative data in this section.

Firstly we will analyze the statutes of the Portuguese universities, considering that the statement of the “third mission” is the first allusion to entrepreneurship concerns.

1. Is knowledge and technology transfer, for societal development purposes, part of the Portuguese universities' mission?

⁵³ Communication from the Commission (2006), Implementing the Community Lisbon Programme

Still within the institutional perspective, we will identify the formal implications of the recognized “third mission”, namely if there is a correspondent chair in the Institutions’ administration.

2. In the case that universities state a “third mission”, is there a respective chair in the board?

As we have analyzed, the promotion of entrepreneurship implies the existence of specific support structures, such as departments, centres, knowledge and technology transfer support offices or business development support and facilities. We will therefore identify the existent support structures within the universities.

3. Which are the structures supporting the promotion of entrepreneurship within the institutions?

These indicators will constitute our institutional analysis. We will then focus on each identified dimension, in order to have a global perspective of the institution.

5.1.2. The Education

As we have seen, for the European Union, entrepreneurship education has a crucial role to play in entrepreneurship promotion. Within EU and national policies it is viewed as a means to change mindsets and to create more and better prepared entrepreneurs that will be the future agents of change of an entrepreneurial and innovative society. As referred above, we have distinguished two conceptions of education, one formal and, another one informal. In this section we will focus on formal education. For this purpose, informal education on entrepreneurship is considered to be the education that occurs outside the formal educational curriculum. In the context of entrepreneurship education, it is developed by entrepreneurship centres and technology transfer offices, and therefore we will analyze it in the next section.

Our target in this part of the study is to identify the different degrees containing entrepreneurship subjects in their curricula, as to capture entrepreneurship implementation in formal education. The analysis of its implementation will consider the fields of study degrees and their level of education. Specific courses on Entrepreneurship will also be considered. As stated above, this section will have a quantitative component, to assess the degree of implementation of entrepreneurship education in each university as well as to enable its comparability.

1. Identification of every subject that refers the word “entrepreneurship” in its name and entrepreneurship courses within each university’s degree.
2. Identification of the fields and level of studies of the degrees containing entrepreneurship subjects.
3. Identification of the fields and level of studies of specific courses of Entrepreneurship.
4. The analysis of the data within the following dimensions: fields and levels of studies.

Our intention with this analysis is to understand in which fields and levels of studies is entrepreneurship education carried on, as well as to assess its degree of inclusion in the different fields of study.

5.1.3. Entrepreneurship and Technology Transfer promotion

As we have analyzed, universities may implement different structures to support entrepreneurship promotion and technology transfer activities. From entrepreneurship centres to departments, technology transfer offices or incubators, these types of structures usually support the promotion of an entrepreneurial culture within the whole institution, and in some cases they also support the commercialization of R&D results from the university.

As the support structures have already been identified in the first section, in this one, we will focus on the analysis of the constitution of the support structure as well as on the provided services.

We will use some dimensions related to the resource-based perspective and we will also take into account the services proposed, to capture the configuration of the support offices. These dimensions are:

1. The year of the office creation;
2. The number of staff working at the office;
3. How entrepreneurship is promoted;
4. The services proposed to support knowledge and technology transfer;

We intend to identify the resources of these offices, based on their organization, as well as to analyze the services which have been developed.

5.2. Study limitations

Our study has certain limitations because our analysis has been based on the available information in the institutional Websites of the universities, due to the difficulty of accessing information. We recognise that the level of available data was not the same in every institution. However within the national Technological Plan presented in chapter 4, taking into account the measures related to increasing the offer of on-line public services, Portuguese universities have implemented a greater level of on-line services and information, enabling, in our specific case, the access to all study plans of first cycle degrees, as well as to the majority of second and third cycle degrees. Regarding the technology transfer offices and entrepreneurship promotion, one of their main concerns is to be known within the university community, as well as to the stakeholders. Therefore, a significant part of their information, especially the one referring to the provided support and services, is also available on-line. The only exception was the *Universidade de Trás-os-Montes e Alto Douro*, for which we did not find any website with information about these support services. However their existence was identified in the university according to the Rector's intervention in 24/03/2009.

As we have stated, to validate our data and support our study we have participated in an entrepreneurship seminar dealing with universities, which was organized by Ciencinvest on May 24th, 2010. We have also participated in two sessions of the entrepreneurship “open-subject” of UL INOVAR, in order to have a direct experience on entrepreneurship education.

Therefore we consider that our data collection is valid and representative of the Portuguese academic entrepreneurship in the studied institutions.

Actually our first intent was to start our study by a questionnaire, aiming at an extensive data collection on TTO activities, directed to the technology transfer offices of the Portuguese public universities, but, despite our insistence we only got one respondent (*Universidade de Coimbra*). Therefore we have decided to pursue the study with the information available on the WebPages of the universities, as the information related to our second and third line of analysis is usually available for public consultation, for marketing and advertisement reasons (capturing students, and passing information to researchers and enterprises).

In the institutional framework, it was not possible to analyze financial matters, namely the allocation of financial resources to entrepreneurship promotion and technology transfer support.

In the education analysis, all the institutions have the study plan of each degree available on their webpage. In general, we have analyzed the institutional webpage, however in some cases it lacked information, and in those cases we have also consulted the organic units (O.U.) and departments' WebPages. We have analyzed the curriculum of each degree to identify entrepreneurship courses, and three situations should be reported:

1. The lack of information on the elective subjects;
2. The cases in which the electives were “open elective subjects” meaning that any subject of the organic unit, or of the whole university would be a possible choice for the students (*Universidade de Évora* and *Universidade de Aveiro*);
3. The analysis of the course content of subjects of management, economy and innovation.

In the first situations, we have tried to analyze the organic unit, department or course webpage, in order to access more information, which in some cases was successful. Regarding the later two, we have disregarded these matters because of two reasons: in the case of “free electives”, in which there are actually subjects of entrepreneurship in other degrees, the offer of optional subjects is so great that the number of students that actually will access entrepreneurship courses must be irrelevant. In the case of courses of management, economy and innovation, we agree that these courses will teach business and management fundamentals, but as we were looking specifically to entrepreneurship courses, aiming at creating an entrepreneurial mindset in the students, they were not considered for this study.

Regarding the entrepreneurship promotion and technology transfer support offices, as our aim was to identify a general entrepreneurial institution; we have focused on the services offered mainly to the university community and entrepreneurs, more than on each specific offer.

6. Empirical evidence and main findings

In this section, we will analyze the entrepreneurial situation of the Portuguese public universities. The above identified dimensions will be studied as sub-sections: The Institutional, the Educational, and the Entrepreneurship promotion and knowledge transfer support. Within each dimension, we will focus on the analysis of the identified indicators.

Fifteen universities have been analyzed, but only fourteen will make part of this study. In fact, the *Universidade Aberta* is not included in this study, because there was no evidence of any entrepreneurial activity in the institution, due to its condition of long distance learning.

As a general finding, from the information gathering, it is possible to say that, within all institutions, entrepreneurship is connected to knowledge and technology transfer and commercialization and also to students' employability and innovation.

6.1. Interviews Analysis

In our study we made interviews with TTO professionals in order to validate our line of analysis about the support given by the Portuguese public universities to entrepreneurship dissemination. The interviews consisted in seven open questions on the importance and the role of entrepreneurship in universities, its components and aims, as well as the existence of eventual barriers and the role of the government.

When asked about the importance of entrepreneurship promotion in universities, all respondents stated reasons related to the application of knowledge to the market, as well as to the regional economic development. This could happen with the support of the enterprise creation process (Mr. João Amaro, from *Universidade do Algarve - CRIA*). It was also enhanced its contribution for the creation of high-qualified work-posts in the university's region, creating employment and fixing people in the region.

The interviewees reported that universities should promote entrepreneurship through education and directed training to their students, researchers and teachers, providing them with the needed tools for creating new enterprises. On an interview to the web-radio of university of Verona, Mr. Nuno Silva (*Universidade de Lisboa – UL INOVAR*) and Mr. José Ricardo Avilar (*Universidade de Coimbra – IPN*) stated the importance of training researchers. During their normal education path, the majority of them can

neither access the required learning skills to create a new enterprise, nor the specific tools for intellectual and industrial protection or communication, which are needed to sell their projects. Researchers may become entrepreneurs, and therefore they should learn to think as one.

Knowledge and technology transfer is considered the “distinctive component of entrepreneurship promoted by universities” (Mr. Filipe Castro, *Universidade do Porto*, UPIN). The importance of a professional staff, specialised offices and specific infrastructures to support these activities is stressed in all the interviews. Interestingly, Mr. Nuno Silva (*Universidade de Lisboa – UL INOVAR*) alerted to the fact that universities should not support knowledge transfer in a unique perspective of generating financial income. He referred the example of the length of time needed for the establishment of a medical patent, the ones that are most financially rewarding, but require nearly ten years before its approval for commercialization.

Regarding the obstacles to universities’ entrepreneurship interviewees appointed red-tape, the lack of entrepreneurial commitment from academics, but mostly market and economic circumstances and cultural contexts. In what regards spin-off creation, Mr. Jorge Figueira (*Universidade de Coimbra*, DITS) also reported the lack of funding in the proof of concept phase. Entrepreneurship promotion is still a recent concern in all universities, impeding to qualify them as entrepreneurial universities, despite the efforts deployed to achieve it (Mr. Castro, F.).

Finally, in what regards the role of the Government, the inquiries consider that it has been supporting entrepreneurial initiatives through different programmes related to human, financial and logistic resources. The financing role is enhanced, in direct or indirect forms. UL INOVAR emphasises the potential of introduction of fiscal policies to motivate the creation of new enterprises combined with simultaneous public buying policies, stating the obligation of public buying from new companies.

The interviews have confirmed our line of analysis, regarding the educational and the knowledge transfer dimensions.

6.2. The Institutional Dimension

Following the first line of analysis we can say that all the Portuguese public universities are committed to the “third Mission”. In all the analyzed cases, knowledge transfer and regional or societal commitment are part of the main purposes of the universities, stated

in their Statutes. This finding was not surprising once the approval of the Act on the Juridical Regime of Higher Education Institutions, and the consequent revision of the statutes of all HEI, states that knowledge transfer and valorisation and the development support are competencies of higher education institutions (Lei n.º 62/2007, Article 5, d) and f)). Moreover, in six Institutions, entrepreneurship was found to be part of the mission.

Table 6.1.: Analysis of the statutes and the institutions board

Universities		IUL	UAC	UALG	UA	UBI	UC	UE	UL	UMA	UMI	UNL	UP	UTL	UTAD
Statutes	3rd Mission	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Entrep.					X			X	X	X			X	
Board	Chair	X		X	X	X	X	X	X		X	X	X	X	X

Notes: Concerning the Chair, for the universities that are not checked, the information was not available.

Regarding the institutions board, in the majority of universities (11 out of 15) there is a Vice-Rector or a Pro-Rector with one of the competences of research, knowledge transfer, entrepreneurship or innovation. Usually, the support and promotion offices identified the Pro or Vice-Rector in charge.

In what regards the existent structures within universities, concerning entrepreneurship and knowledge and technology promotion, several type of structures were identified, related to the following activities: policy and follow up; promotion and support; education and research.

Regarding policy and follow up, two institutions were found to have a commission for entrepreneurship and knowledge transfer (UL and UNL), composed by the Vice-Rector in charge of the chair, as well as professors from different organic units. In *Universidade Nova de Lisboa*, there is an entrepreneurship department at the Rectorate level, to coordinate entrepreneurship activities in a transversal mode within all its organic units. At *Universidade de Lisboa* there is a follow up commission to direct and assess the results of the TTO activities.

All universities have transverse support units of knowledge transfer and/or entrepreneurship (Appendix Table 6.2.) and these offices are generally on a direct dependence from the Rectorate, coordinated by the Vice or Pro-Rector for the area. In some cases, beyond the transversal structures, there are also offices at the level of organic units (UNL – at its faculty of sciences and technology; UP – at its faculty of

engineering; UC – at its faculty of engineering; and UTL – at its institute of engineering (IST)).

Regarding education, in the analyzed majority of the non economic and management degrees, it was not possible to assess which was the original department of entrepreneurship subjects. However, the inexistence of specific entrepreneurship educational departments, transversal to all fields was confirmed.

In what concerns research on entrepreneurship, except for *Instituto Universitário de Lisboa* that has a specific research centre, in the remaining institutions entrepreneurship research is developed mainly within lines of research of specific centres. Most lines of research were found within economic and management research centres. It is however interesting to refer that entrepreneurship research was also found in different research areas, such as Sociology and Engineering at UP (ICS and INESC), Engineering at UTL (engineering institute); and within an interdisciplinary centre at UTAD (CETRAD).

In an institutional perspective, all the Portuguese Public universities seem committed to entrepreneurship and technology transfer matters. It is part of their missions, and they have a chairman within their board who is responsible for these matters. In all of the universities, structures developing entrepreneurship education, research and promotion as well as knowledge and technology transfer support, were found. The professional support structures seem to be more organized and developed towards entrepreneurship than the educational and research structures, which in the majority of the cases that we were able to confirm were performed at economic and management organic units, without a specific department. But let us analyze its practical implementation in each dimension, in order to evaluate its consistence with the universities' missions.

6.3. The Educational perspective

In what regards the educational perspective, our analysis was focused on the curricula of the courses to identify specific entrepreneurship subjects. We have analyzed the curriculum of each course in the Portuguese public universities, to identify specific entrepreneurship subjects, preferably with the name in it, and we have grouped them according to the fields of studies. Both compulsory and elective subjects were considered, but in the case of the electives, the so-called “free-option” subjects comprising subjects from any degree and in any area were not considered, as the

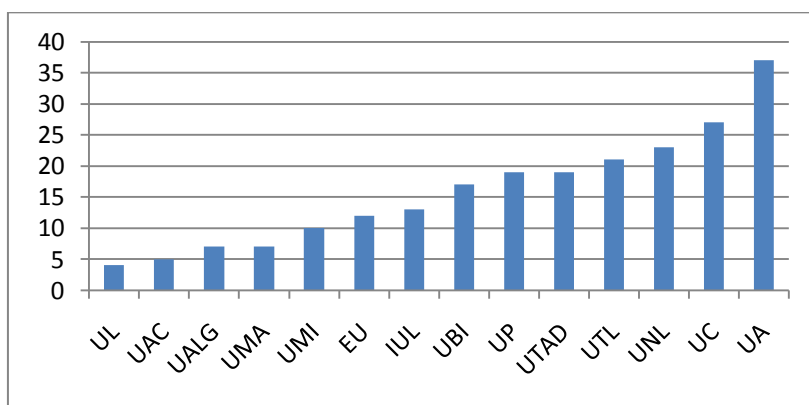
possibilities of choice were so vast that the probability for the students to access entrepreneurship was diminished.

We have identified four fields that were representative, which have met the interest of our study. These were science and technology fields, which incorporated all the fields related to science and engineering; economy and management, including economy, management, marketing and human resources diplomas; others, which incorporated areas that were not representative by themselves in the global analysis, such as tourism, sports, languages, education, health and fashion fields; and finally, entrepreneurship, that comprised specific degrees and diplomas on behalf of entrepreneurship, excluding degrees and diplomas on themes related to technology transfer, innovation and intellectual property.

Regarding the offer of the educational analysis, the most evident finding is the great level of disparity between the universities. If in the one hand, all the universities offer at least one chair on entrepreneurship, their degree of implementation, the levels of study prioritized, and the fields of study differ. The implementation of entrepreneurship subjects in all fields is not consolidated in any case, with the fields of arts, humanities and education, and those of health sciences very much underrepresented.

The first finding is that all universities of the study offer, at least in one degree, one subject of entrepreneurship. However, we have found a huge disparity between universities concerning entrepreneurship subjects' offer – in one of them thirty seven degrees were identified and in another only four.

Figure 6.1.: Number of degrees per university offering entrepreneurship subjects as integrant part of their curricula (in compulsory or elective base) – Appendix – Table 6.3.



As we can see in figure 6.1., the level of implementation of entrepreneurship subjects as part of the degrees curricula is very diverse. This diversity can be explained by the heterogeneity of higher education institutions, due to factors dealing with their fields of study and the time when entrepreneurship was implemented.

Regarding the field of studies, there are institutions which do not have any associated with entrepreneurship. For example, *Universidade de Lisboa* does not have an economic and management school, despite the existence of isolated subjects in its different faculties and its exploitation in specific fields such as law, or educational sciences. In this university, entrepreneurship teaching occurs formally in its faculty of sciences, within subjects of innovation and technological transfer. The University has, among others, faculties of pharmacy, education and fine-arts, in which entrepreneurship subjects would well fit both knowledge transfer, mindset creation and firm creation purposes. On the other hand, the *Instituto Universitário de Lisboa - ISCTE* has departments of economy and information technology, in detriment of the existence of a sciences department. There, entrepreneurship subjects are predominant in non scientific and technological fields.

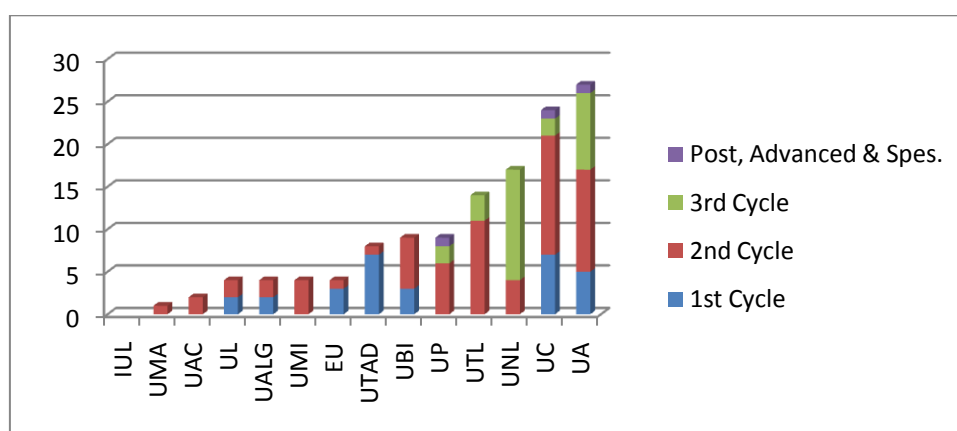
In what concerns time factor, *Universidade de Lisboa* and *Universidade dos Açores* have implemented entrepreneurship education in the curricula in a recent phase, since 2007, and consequently do not have many degrees with entrepreneurship subjects, in comparison to other institutions, like *Universidade de Coimbra* or *Universidade de Aveiro* that seem to have a more consolidated implementation of entrepreneurship education.

If we look at the areas in which entrepreneurship is taught, based on the total number of degrees with entrepreneurship subjects, surprisingly we find that 57% of entrepreneurship subjects are lectured in science and technology fields, compared to only 24% in economy and management fields and 13% in other fields. This is a surprising finding, once one of the critics to entrepreneurship education consists in its tendency to be lectured in business faculties and schools. If we analyze this same question in terms of the number of universities broken down by the field of study in which most entrepreneurship subjects are lectured, the result is the same, 9 out of 14 universities give priority to entrepreneurship subjects in science and technology degrees.

If we analyze the teaching of entrepreneurship subjects in each field of study, regarding science and technology field of study, entrepreneurship subjects are dominant in the

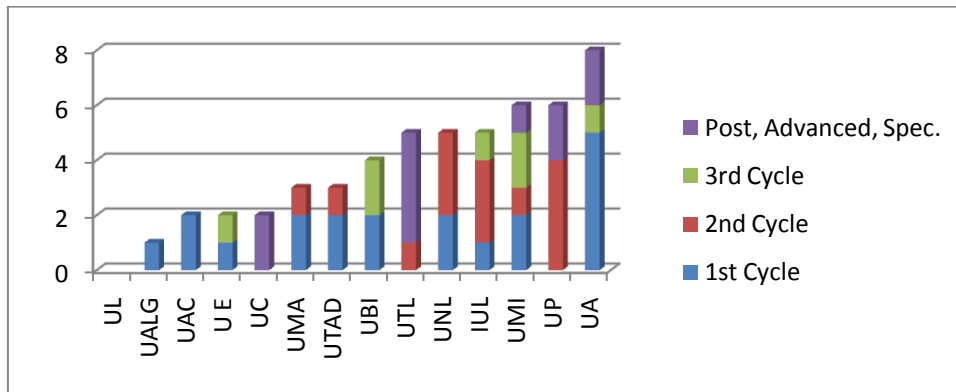
second cycle of studies, corresponding to 53% of subjects in master degrees. All universities that lecture entrepreneurship in this field have implemented it at the Second cycle (Figure 6.2.). Regarding the first and third cycles, the share of subjects occurrence at these levels is the same, 23% for each, though more universities introduce entrepreneurship subjects in the first cycle than in the third one. Both universities of Coimbra and Aveiro offer entrepreneurship subjects in science and technology degrees in all levels of study.

Figure 6.2.: Entrepreneurship subjects in Science and Technology studies – Appendix Table 6.3.



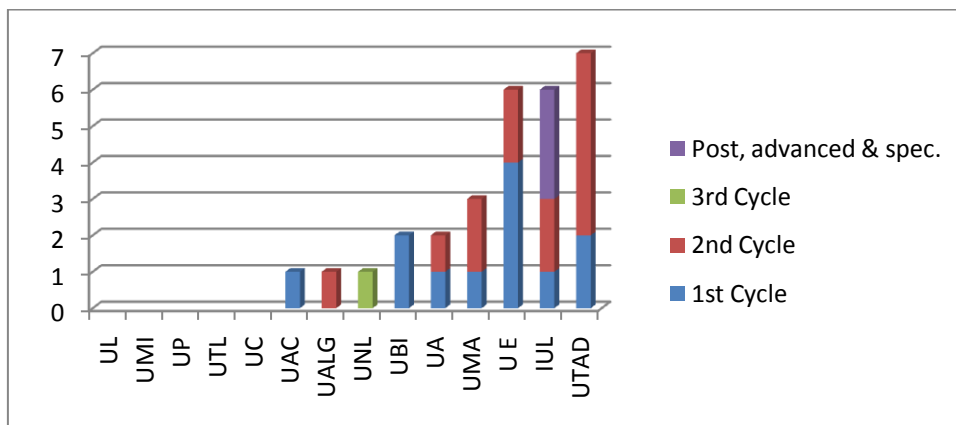
In what concerns economy and management field of studies (Figure 6.3.), entrepreneurship subjects are more dispersed through the different levels of studies, though the majority are lectured in undergraduate studies, with a share of 38% of occurrences, followed by master studies with an incidence of 28%. It is interesting to refer that subjects of entrepreneurship have an important presence at the level of post-graduate studies and MBA (20%), in comparison with the other fields of study. Doctoral programmes are less represented with 13% of incidences, but they often offer the possibility of specialization in the entrepreneurship area. The *Universidade Nova de Lisboa* and *Universidade de Aveiro* stand out from the group in that they have a significant number of third cycle degrees with entrepreneurship subjects (13 and 9 respectively).

Figure 6.3.: Entrepreneurship subjects in Management and Economy studies – Appendix Table 6.3.



Other fields (Figure 6.4.) include mainly education, sports, arts, culture and social intervention areas. In what regards other fields of studies, it is interesting to note that a fewer number of universities (9 out of 14) have introduced entrepreneurship subjects in other fields, and within the ones that have it, its general representation in comparison to the other two fields is much smaller. Three universities stand out from the remaining, giving emphasis to entrepreneurship teaching in other fields (IUL, UE and UTAD). The teaching of entrepreneurship is more significant in undergraduate and master programmes with respectively 41% and 45% of representations.

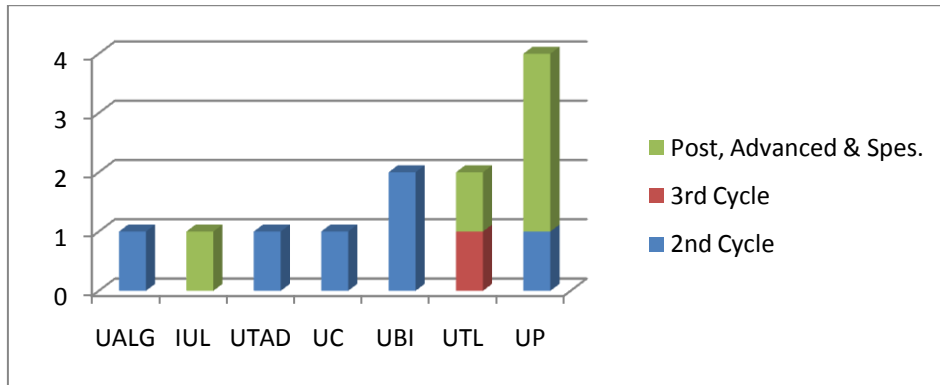
Figure 6.4.: Entrepreneurship subjects in other fields of studies – Appendix Table 6.3.



Regarding the entrepreneurship courses themselves, the majority consists in master degrees and post-graduations. They only represent 5% of the identified degrees, and only half of the universities analyzed lecture them (See Figure 6.5.) The majority of

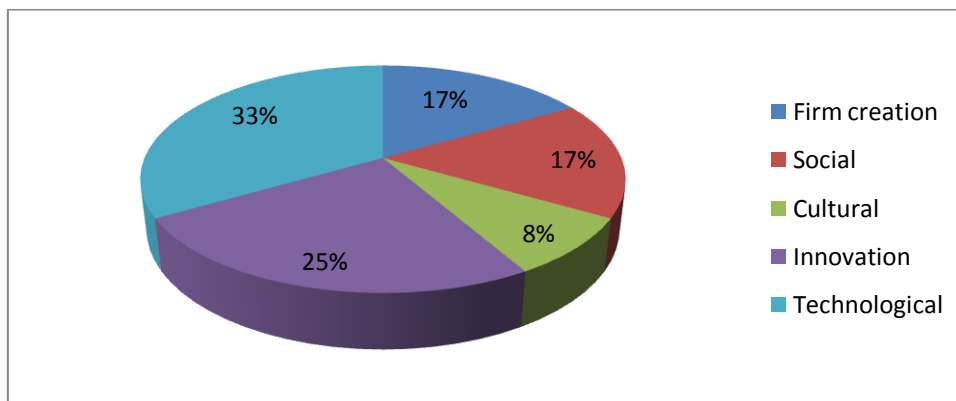
universities lecture one or two courses, and only *Universidade do Porto* lectures four courses.

Figure 6.5.: Number of Entrepreneurship degrees or specializations offered by the analyzed Universities, broken down by the level of study



Within entrepreneurship, the fields that are more explored are innovation and technological entrepreneurship (See Figure 6.6.). The importance of international cross-Atlantic partnerships in this specific area is relevant in degree courses. For example both UTL and UP offer their degrees in collaboration with American universities (MIETE 2nd Cycle at UP in collaboration with North Carolina State University and the third cycle of UTL within the CMU agreement and in collaboration with the *Universidade Católica Portuguesa*). *Universidade Técnica de Lisboa* is the only institution in this study delivering a doctoral specific programme on entrepreneurship.

Figure 6.6.: Fields of entrepreneurship degrees and diplomas

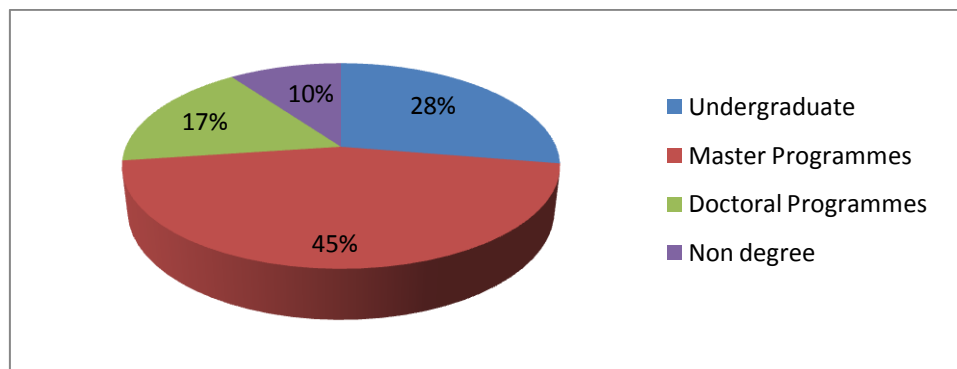


As to technological transfer, intellectual property and innovation fields, there are a small number of degrees that were not considered in this analysis because their focus was not

on entrepreneurship. However it seems relevant to refer that they exist, and that half of them are lectured in the third cycle, as doctoral programmes or advanced studies (Appendix, Table 6.4.).

Regarding the level of study, in most cases (45%) entrepreneurship subjects are lectured in the second cycle of studies. First cycle degrees represent only 28% of the offer of entrepreneurship subjects.

Figure 6.7.: Level of studies with entrepreneurship subjects or entrepreneurship studies



However universities implementation of entrepreneurship attitudes is not limited to education, and even in education, it is not limited to formal education. There is a considerable number of initiatives occurring mainly at the levels of knowledge transfer and entrepreneurship promotion, that impacts in the development and consolidation of entrepreneurship within institutions.

6.4. Knowledge transfer and entrepreneurship promotion

When analysing entrepreneurship promotion, knowledge and technology transfer offices, according to their year of creation and staff, we find a great level of disparity. It is clear that some institutions are more experienced than others, due to the duration of its offices (Appendix Table 6.5.).

In the majority of the cases, the offices were created from 2003 on, a great part of them having been originated by the OTIC initiative (2006). However, before that date, some institutions had already developed through other means, knowledge and technology transfer activities at the level of their sciences and engineering faculties, by the establishment of associations: UP since 1986 (INEGI); UNL since 1986 (UNINOVA); UC since 1991 (IPN); UL since the late 80s (ICAT); UA since 1998 (Gruponave).

In what regards the number of employees to develop these activities, again the scenario is quite diverse. Regarding the transversal offices, half of the institutions have 2 to 5 staff members. The other half has more than 6 staff members, two of which have staff teams of more than 10 employees (UALG and UMI). In the cases where other structures of support exist, such as offices at O.U. levels or incubators, low staff numbers may not be an impediment for the development of entrepreneurship and technology transfer (UA, UC, UTL, UNL, UP). Interestingly, the small sized units are found in recent offices, less than 5 years old, and correspond to the universities that have the smallest offer in entrepreneurship education. This may be an indicator of the level of universities' investment in this area within those institutions.

In the majority of cases, entrepreneurship promotion is developed under knowledge transfer offices, which in few cases are organized in sub-units within the office, according to the proposed services (Appendix Table 6.6.).

Considering the type of support that the identified structures offer, the general finding is that in most cases knowledge and technology transfer offices engage in activities of: (1) entrepreneurship promotion, aiming at technological entrepreneurship or self-employment; (2) intellectual property management; (3) spin-off support and start-up creation; and (4) fostering the links between university and enterprises.

Entrepreneurship promotion activities take the form of training and motivation of the university community. In what concerns entrepreneurship training, most of the structures offer entrepreneurship courses. In some cases the courses are part of the formal education of the institution, such as entrepreneurship subjects that integrate the students' formal curricula. UL INOVAR and UNL's entrepreneurship department organize programmes in the form of transversal "free-option" subjects for all Master students and, at UL, also for PhD students. At UAC, the entrepreneurship subjects analyzed above are organized in collaboration with the Entrepreneurship Centre. All the structures organize several courses, in the form of training and specialisations, most of them on entrepreneurship or technological entrepreneurship. The course contents seem to be very practical, with coaching and hands-on approaches, aiming at motivating the students to entrepreneurship but also to actually identify some students with potential entrepreneurial ideas and helping them with its exploitation.

The interaction between the structures of the different universities is evident by the organization of integrated courses. For example, UA, UBI and UC offer a common

course on technology-based entrepreneurship (CEBT) in collaboration with the Trade and Industry Chamber of the Centre Region.

Apart from training, all the structures organize different initiatives to motivate and raise the university's awareness, including ideas and business plan competitions, workshops and conferences. TECMINHO has created an ideas' development laboratory (2009), with counselling and orientation services, to process students' business ideas. *Universidade do Porto* has organized an entrepreneurship club, for all its community, with the objective of bringing together all its members who are willing to take part in all entrepreneurship dimensions.

In what concerns the valorisation of research results, all the structures support and orient students, teachers and researchers during the knowledge transfer process (type of transfer, IP protection and contracts writing). The majority of the identified transversal knowledge transfer offices (Appendix Table 6.6.) refer to firm creation (spin-off, technological firms) as one of their objectives. The support proposed to spin-off and start-up creation usually consists on training, orientation activities such as ideas evaluation and counselling, IP protection, business plan design, and support in finding funds for starting-up. A number of institutions are developing their own spin-off brand, to award the spin-offs resulting from the university's projects (UMI, UP, UAC, IST from UTL). TEC-Minho and TT@IST were the only identified structures which provide seed capital funds. The other identified structures rely on public funding programmes for spin-off and start-up financing (FINICIA, COTEC). Some of the identified structures have limited their activity to spin-off promotion, due to the fact that the existing incubator structures within the university have the role of practical support to spin-off creation and development, as we will see below.

Within the aim of fostering the links between universities and enterprises, all knowledge transfer structures perform scrutinising activities, as to identify the research potential within the institutions that may be valued by the market, and also the identification of opportunities and specific market needs that may be resolved by the institution.

All structures collaborate with national supporting programmes, as FINICIA from IAPMEI or COTEC. Networking activities are performed by all Offices, for purposes of fund raising or development of R&D collaboration projects, but also within networks of training and experience sharing at national and international level (UTEN). For example, *Universidade de Coimbra* has developed a partners' typology, with specific advantages, considering the offered level of financial support.

As stated before, some knowledge and technology transfer offices have a limited action in supporting spin-off creation, because of the existence of other structures with the same purpose. In fact some universities have incubator structures that work in collaboration with the knowledge transfer offices, or space facilities (Appendix, Table 6.7.). The incubators provide specific facility services as well as management and administrative support, but also consultancy and training services and in some cases access to seed and venture capital.

Most of the universities are shareholders or collaborate with science parks (except IUL and UL). The advantages of these collaborations for universities consist in providing a favourable environment to build a bridge between university and industry, enabling the development of R&D activities in close cooperation with enterprises. It is also a place to develop spin-off activities, which matches all the dimensions and purposes of building an entrepreneurial university.

The Universities that seem to be in better condition to develop their entrepreneurial capability, regarding the existent support structures of knowledge transfer and entrepreneurship promotion and considering the services that are provided are: *Universidade de Aveiro, Universidade de Coimbra, Universidade do Minho and Universidade do Porto.*

7. Conclusion and Discussion

In our study about the Portuguese Public Universities, we have analyzed the different institutions in different dimensions that we have identified as being the components of entrepreneurship promotion within universities. The analysis was aiming at providing a transversal overview on the initiatives that are being implemented to support its development.

The existence of a third mission in all the universities has been confirmed. Knowledge transfer and regional or national development are part of the mission of every analyzed institutions. In accordance to their mission, all universities have a Vice-Rector or a Pro-Rector responsible for its development.

Concerning the existence of structures for education and research on entrepreneurship, despite the inexistence of entrepreneurship departments for formal educational purposes, in several universities entrepreneurship is indeed a research line within research centres. Moreover, in some cases, the research centres performing entrepreneurship research were not related to economic, management or business fields. This is a significant finding, to enable the development of entrepreneurship studies.

Despite a general recognition of the needs of academic entrepreneurship, knowledge transfer and societal development from all the institutions and after analysing its effective implementation, we believe that a greater commitment is needed within all the institutions and, in some, a greater investment on its structural support.

Regarding education, all universities were found to deliver entrepreneurship education within their degrees. However there are great disparities in its conception and level of implementation. The EU recommendation that all students should have been lectured entrepreneurship is not guaranteed by the curricula design. In a universe of 652 undergraduate degrees, 1392 Master programmes and 644 Doctoral programmes, our identification of 221 degrees with entrepreneurship subjects, seems irrelevant. Of course there is a considerable number of free optional subjects, which any student may access, but this implies that he or she has already some previous interest or knowledge on entrepreneurship. Even open subjects have a limited number of vacancies, or may interfere with the students' timetable. Therefore if they are an opportunity for interdisciplinary entrepreneurship discovery, they also may not be accessible to such a wide public as it is initially intended.

Universidade de Aveiro was found to be the institution that most explores entrepreneurship education within the different fields of study and *Universidade do Porto* as the one that offers more entrepreneurship degrees. *Universidade Técnica de Lisboa* was the only one offering a third cycle on entrepreneurship.

Coming back to formal education, the priority given to entrepreneurship teaching within scientific and technological fields is evident with 57% of the subjects implemented in this field of study. No less evident is its predominant occurrence at second cycle studies, with a share of 45% of the degrees with entrepreneurship subjects. This is understandable for two reasons. First as we have seen during this study, a great part of universities' entrepreneurial activity is related to sciences and technology transfer, though science and technology are preferred fields. Second, students from second cycle, have a greater research maturity than first cycle students, which is needed to develop entrepreneurship activities related to knowledge transfer.

Entrepreneurship subjects in economy and management fields of study were found to be present in the different levels, but with special incidence at undergraduate level (37%). This is also understandable, because in these fields entrepreneurship is more related to firm creation, not implying so much research activities to support its development, but instead more practical skills.

The existence of entrepreneurship teaching in the remaining fields of study has been found to be less implemented, with a slight 13% of occurrences. Fields of health sciences, design and architecture, tourism, sports, sociology and education were identified, but underrepresented. We believe that entrepreneurship is critic in all these areas, and its implementation should be fostered. Surprisingly, entrepreneurship teaching is almost inexistent in educational sciences degrees. This raises the question on how can entrepreneurship be implemented and developed in all educational institutions and in across all levels of education, if it is not a subject of educational sciences concerns. Even within the HEI, the need for the developing of research lines in entrepreneurship education seems evident for the development of institutional entrepreneurship.

In areas of study with greater levels of unemployment, entrepreneurship should be explored, as to create the famous entrepreneurial mindset among the students, providing them with the needed skills for opportunity recognition and searching.

In the same line of our finding about entrepreneurship subjects, the majority of entrepreneurship degrees and courses tend to be oriented towards the fields of

technology and innovation. The number of identified entrepreneurship degrees is quite modest, and the majority consists in second cycle and specialisations. Only one third cycle was found, which was offered by *Universidade Técnica de Lisboa*, within the CMU-Portugal agreement, and in collaboration with *Universidade Católica Portuguesa*. However, we have also identified some degrees related to technology transfer and innovation in third cycle of studies. These degrees stimulate the advance of research in knowledge and technology transfer fields, which ultimately seem to be the most explored form of entrepreneurship within all the analyzed institutions. The use of international collaborations in this specific field has been identified in UTL and UNL, and seems to be a good practice to provide students with an experience of other realities, usually in highly innovative and entrepreneurial contexts.

According to what has been analyzed, it is crucial to have more specific formal degrees on entrepreneurship, as to develop research on the field, but mostly as to qualify teachers who lecture within this field. The lack of third cycle degrees seems to be an opportunity that should be explored by universities.

Consistent with previous studies, this one reveals that entrepreneurship at universities is still underdeveloped, despite the existing possibilities within universities contexts. Nevertheless good practices were also identified, and eventually a greater level of experience sharing in this field, would benefit all. Time factor has also revealed to be significant, as institutions that are more experienced, seem to have a greater overall performance.

All the analyzed institutions were found to detain specific transversal structures for knowledge transfer support and entrepreneurship promotion. Most of these structures are quite recent, having less than ten years. In some cases, however, the prior existence of parallel entities for the development of technology transfer, were found, promoted by specific organic units. Some universities have also decentralized structures, within specific organic units. In all the analyzed universities, the structures either transversal, or a combination of the transversal and the decentralised ones, performed both activities of knowledge transfer support and entrepreneurship promotion.

In what concerns the size of the professional staff, there is a great disparity among institutions, with offices with 2 professionals, to others with up to 18. A small sized human resource unit, without any other support structures may be impeditive of a further development of activities. Actually, the universities that seem to be more engaged with entrepreneurship, according to the available information and in terms of

entrepreneurship education, research and promotion structures, seem to be the ones with medium size teams in the transversal TTO, supported by the existence of related structures such as decentralised TTO, incubator, but also exploring research and education activities (UC, UP, UA, UTL).

All the support offices were found to have crucial activities related to entrepreneurship education and training, some of them collaborating in the students' formal education, lecturing subjects that may integrate the students curriculum in the form of electives. Regarding informal education, the existing courses are mainly specialisations and have a very practical approach.

Regarding the services provided, the universities' TTO have similar missions and objectives. IP protection has a central role within the overall activities. The services follow a similar line of activities; the difference lay more in the quantity of offer. It is evident that some offices have a greater capacity of promotion and support, as highlighted by the number of different analyzed initiatives (ID Labs; Entrepreneurship clubs, institutional spin-off brands). But then again the institutions investments in human resources may influence the TTO capacity.

The importance of network activities, in experience sharing and fund raising is evident in all the institutions, as well as the level of dependence on public funds.

Some universities were also found to have their own incubators, which usually are located on-campus or close to it. The existence of such structures and their location on-campus are relevant for creating a perception that these activities integrate the normal overall activities of universities and to motivate, teachers, researchers and students.

It would have been interesting to assess the performance and results of the institutions within the identified dimensions in terms of the number of created spin-offs and start-ups originated from the entrepreneurship courses, the type of promoters (students, researchers or teachers) and the generated revenue for the institution as well as its impact for the region. However this would have required a much larger study, to cover all institutions. It would also be much more difficult in terms of data collection as it is very difficult even for each institution to control the number of the generated start-ups and spin-offs, as well as for external researchers to access them and analyze their impact.

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Universidade da Madeira: <http://www.uma.pt>

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Universidade do Minho: <http://www.uminho.pt/>

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Universidade de Trás-os-Montes e Alto Douro: <http://www.utad.pt/pt/index.asp>

Appendix

Table 3.1.: Research effort of EU, US and Japan, in terms of investment

Countries	EU	US	Japan
Research Effort in 1993 (Percentage of total research and development expenditure as a share of GDP)	2%	2,7%	2,8%

Source: Green Paper of Innovation; 1995

Table 3.2.: R&D Expenditure as a percentage of GDP

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
EU (15 countries)	1,84	1,89	1,91	1,92	1,93	1,92	-	-	-	-	-
EU (25 countries)	-	-	-	-	-	-	1,82	1,82	1,85	-	-
EU (27 countries)	-	-	-	-	-	-	-	-	-	1,85	1,9

Source: Eurostat

Table 3.3. : Rate of preference for self-employment compared to the self-employment rate in EU and US

		2000	2002	2004	2007	2008/9
Pref. For self-employment	EU	51%	45%	45%	45%	45%
	US	69%	67%	61%	61%	55%
Self-employment rate	EU	18,30%	17,60%	17,50%	16,80%	16,50%
	US	7,40%	7,20%	7,60%	7,20%	7%

Source: Eurobarometer for entrepreneurship and OECD

Table 4.1.: Evolution of real GDP growth rate in Portugal and EU

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
EU (15,25 and 27 countries)	1,7	2,7	3	3,1	3,9	1,9	1,2	1,2	2,5	1,9	3,2	3	0,5	-4,2
Portugal	3,7	4,4	5	4,1	3,9	2	0,7	-0,9	1,6	0,8	1,4	2,4	0	-2,6

Source: Eurostat

Table 4.2.: Proportion of High-tech enterprises in Total enterprises in Portugal

N.º Entrep. / Time	2004	2005	2006	2007
Enterprises total	844432	874163	888213	891625
Enterprises High-tech	4967	17288	17151	16305
Share of High-tech enterprises in total enterprises	0,59%	1,98%	1,93%	1,83%

Source: Based on data from Eurostat

Table 4.3.: Real GDP growth rate in Portugal, compared to the enterprise birth rate

	1998	1999	2001	2002	2004	2005	2006	2007
Real GDP Growth Rate	5	4,1	2	0,7	1,6	0,8	1,4	2,4
Business Birth- rate	9,45	8	7,46	5,96	13,7	13,31	14,21	13,78

Source: Eurostat

Table 4.4.: Portugal – Real GDP growth rate and Self-employment rate

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Real GDP growth rate	3,7	4,4	5	4,1	3,9	2	0,7	-0,9	1,6	0,8	1,4	2,4	0
Self- employment rate	28,6	28,9	28,1	27	26,1	26,8	26,6	26,7	25,9	25,1	24	24,2	24,1

Source: Eurostat and OECD (2010 Factbook)

Table 6.2.: Identified structures of entrepreneurship and TT of education, research promotion and support

	Commission	Transversal		Organic Unit		Entrepreneurship Education and Research		
		Entrepreneurship Office	KTO; TTO	Entrepreneurship Office	KTO; TTO	Department	R&D Dep. or research units (Eco. & Mngt.)	R&D Dep. or research units (other fields)
IUL		X				Mngt. & Eco	Audax	-
UAC		X				-	C. Empreend.	-
UALG		X				-	-	-
UA			X			-	-	-
UBI		X	X			-	NECE (business sciences)	-
UC			X		X	-	CIM (innov. Mngt)	-
UE			X			Mngt. & Eco		-
UL	TTO Follow up Commission		X			-	-	-
UMA		X				Mngt. & Eco	CEEAA	-
UMI			X			-	-	
UNL	Council for Entrepreneurship	X			X	-		
UP			X	X		-	EDGE (FEP); CEF.UP(FEP)	Sociology (FL); LIAAD - INESC (FEUP)
UTL			X		X			Mngt. Centre at IST
UTAD			X			Mngt. & Eco		CETRAD (SC)

Table 6.3.: Number of degrees per university offering entrepreneurship subjects as integrant part of their curricula (compulsory or elective base).

	Undergraduate			Master Programmes				Doctoral Programmes				Post-Graduations, Advanced Studies, MBA, Specialistaion				Total					
	Science and Technology	Economy and Management	Other fields	Science and Technology	Economy and Management	Other fields	Entrepre-neurship	Science and Technology	Economy and Management	Other fields	Entrepre-neurship	Science and Technology	Economy and Management	Other fields	Entrepre-neurship	Total	Total Science and Technologies	Total Economy and Management	Total other fields	Entrepre-neurship	
IUL		1	1	1	3	2			1					3	1	13	0	6	6	1	
UAC		2	1	2												5	2	2	1	0	
UALG	2	1		2		1	1									7	4	1	1	1	
UA	5	5	1	12		1		9	1			1	2			37	27	8	2	0	
UBI	3	2	2	6			2		2							17	9	4	2	2	
UC	7			14			1	2				1	2			27	24	2	0	1	
UE	3	1	4	1		2			1							12	4	2	6	0	
UL	2			2												4	4	0	0	0	
UMA		2	1	1	1	2										7	1	3	3	0	
UMI		2		4	1				2				1			10	4	6	0	0	
UNL		2		4	3			13		1						23	17	5	1	0	
UP				6	4		1	2				1	2		3	19	9	6	0	4	
UTL				11	1			3			1		4		1	21	14	5	0	2	
UTAD	7	2	2	1	1	5	1									19	8	3	7	1	
TOTAL	29	20	12	67	14	13	6	29	7	1	1	3	11	3	5	221	127	53	29	12	
Percentage	22,83%	37,74%	41,38%	52,76%	26,42%	44,83%	50,00%	22,83%	13,21%	3,45%	8,33%	2,36%	20,75%	10,34%	41,67%						
Total/ Cycle	61			100				38				22					-	-	-	-	
Per-centage	27,60%			45,25%				17,19%				9,95%					57,47%	23,98%	13,12%	5,43%	

Notes:

Integrated 1st and 2nd Cycle were considered in Master Programmes when lectures occurred from 4th year on.

When there were doubts about the field of study, the department of lecturing was considered as the main field of study

In Entrepreneurship, only courses called entrepreneurship were considered, and not courses about innovation or technological transfer

Table 6.4.: Number of degrees in Technology Transfer and Innovation in universities, broken down by the level of study

	2nd Cycle	3rd Cycle	Post-Grad. & Advanced Studies
UA			1 Advanced
UMI		1	
UP	1	1	
UTL	1		1 Post-grad

Table 6.5.: Entrepreneurship promotion and knowledge transfer support structures

Univs.	Entrepreneurship Office	NTO; TTO	Year	Staff
UMI		TECMINHO	1990	18
UALG	CRIA		2003	11
UC		DITS	2003	5
UNL	Entrepreneurship Depart.		2004	-
UP		UPIN	2004	7
IUL	Audax		2005	-
UAC	Entrepreneurship Centre		2006	3
UA		UATEC	2006	8
UMA	GPPC		2006	2
UTL		OTIC-UTL	2006	2
UTAD		GAPI-OTIC	2006	-
U E		OTIC	2006	7
UL		UL INOVAR	2009**	2
UBI	CFIUTE	GAAPI		5*

Notes: * GAAPI 2; CFIUTE 2

** Previous existence of OTIC (2006)

Table 6.6.: Universities structures of knowledge transfer or entrepreneurship promotion and provided support

	TRANSVERSAL		AT ORGANIC UNIT		SUPPORT			
	Entrepreneurship Office	KTO; TTO	Entrepreneurship Office	KTO; TTO	Entrepreneurship promotion	IP protection & valorisation	Spin-off & Start-up support	Link Univ. Enterprises
IUL	Audax				Yes	-	Yes	-
UAC	Entrepreneurship Centre				Yes	-	Yes	Yes
UALG	CRIA				Yes	Yes	Yes	Yes
UA		UATEC			Yes	Yes	Yes	Yes
UBI	CFIUTE	GAAPI			Yes	Yes	Yes	Yes
UC		DITS		1	Yes	Yes	Other *	Yes
UE		OTIC			Yes	Yes	Yes	Yes
UL		UL INOVAR			Yes	Yes	Yes	Yes
UMA	GPPC				Yes	Yes	Yes	Yes
UMI		TECMINHO			Yes	Yes	Yes	Yes
UNL	Entrepreneurship Depart.			1	Yes	Yes	O.U.**	Yes
UP		UPIN	1		Yes	Yes	Yes	Yes
UTL		OTIC-UTL		1	Yes	Yes	O.U.**	Yes
UTAD		GAPI-OTIC			-	Yes	-	-

Notes:

- No information available for UTAD or no evidence within the identified structures.

* At *Universidade de Coimbra*, the incubator supports spin-off and start-up creation.

** At *Universidade Nova de Lisboa* and *Técnica de Lisboa*, spin-off and start-up creation are supported by the K&TTO at Organic Units level.

Table 6.7.: Universities with university’s incubators

University	University Incubator	Incubator Services	Filed
UALG	On-campus, space facilities	Space	-
UA	IEUA Incubator	Space, consultancy, fund raising support, training, coaching.	Any
UC	IPN Incubator	Space, consultancy, network, training, coaching, and venture capital.	Any, if technology based, Advanced services, or innovative
UL	On-campus space facilities at 2 R&D centres (IMM, ICAT)	Space	Health Sciences (IMM)
UMI	Spinpark Incubator	Space, consultancy, network, training, seed and venture capital.	Any
UP	UPTEC Incubator	Space, consultancy, network, training, coaching, seed and venture capital.	Any
UTL	INOVISA (ISA)	Space, consultancy, fund raising support, training, coaching.	