AN EMPIRICAL-INSTITUTIONAL ANALYSIS OF FACTORS AFFECTING THE
ENTREPRENEURIAL UNIVERSITY

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STATEMENT OF ORIGINALITY

I hereby declare that the research recorded in this thesis and the thesis itself, were developed entirely by myself at the Organisation and Industrial Management Area, Department of Mechanical and Manufacturing, at the University of Mondragon.

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Bihotz-bihotzez, mila esker guztioi!

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Leire Markuerkiaga Arritola.

LABURPENA

Unibertsitatea historia luzea duen erakunde bat da, zeinek mendeetan zehar hainbat fase ezberdin izan dituen (Martinelli et al., 2008). Hasieran batetan irakaskuntza "misio" bakar bezala izan bazuen ere, geroago unibertsitateak jakintza sortzeko (ikerketako) rola hartu zuen; "bigarren misio" bezala. Gainera, azken urteetan, unibertsitate honek "hirugarren misio" bat garatu du, gizarte eta garapen ekonomikoan zuzenean laguntzea; Unibertsitate Ekintzaile batetan bilakatuz. Baina zerk osatzen du Unibertsitate Ekintzaile hau?

Badira Unibertsitate Ekintzaile batean ikuspegi ezberdinak, baina ez dago adostasunik bere osagai nagusien inguruan (Rothaermel et al., 2007, Guerrero and Urbano, 2010). Izan ere, azken urteotan, Unibertsitate Ekintzaileak arreta handia jaso du ikertzaileen aldetik (O'Shea et al., 2004, Guerrero et al., 2011). Hain zuzen ere, eredu teoriko batzuk garatu dira, besteak beste Clark (1998), Sporn (2001), Etzkowitz (2004), O'Shea et al. (2007), Peterka (2008), Guerrero and Urbano (2010), Salamzadeh et al. (2011), Gibb (2012), European Commission (2012) eta Mavi (2014). Hala ere, oraindik gutxi aztertu da unibertsitate honen sorreran laguntzen duten faktoreen ezagutzaren inguruan (Rothaermel et al., 2007, Guerrero et al., 2011). Ikerketa enpirikoen eza ageri da faktore horien eraginen inguruan, arlo honetan ekarpen garrantzitsuak egiteko aukera handi bat eskainiz.

Beraz, ikerketa honen helburu nagusia Unibertsitate Ekintzaile baten eragiten duten faktoreen azterketa enpiriko-instituzionala egitean datza. Horretarako, Unibertsitate Ekintzaile eredu bat garatu eta enpirikoki egiaztatu da; non unibertsitatearen kanpoko inguruneak, unibertsitatearen barruko ezaugarriek eta ekintzailetza bultzatzeko mekanismoek Unibertsitate Ekintzaileen emaitzen gainean duten eragina aztertzen den.

Aurreko helburua betetzeko, ikerketa honek ikuspegi kuantitatiboa jarraitu du. Gainera, ikerketa estrategia bezala inkesta erabili da eta analisi unitatea unibertsitatea bera izan da; zehazki, unibertsitatearen hirugarren misioa bultzatzen duten Europar unibertsitateak.

HITZ GAKOAK

Unibertsitate Ekintzailea, Ekintzailetza Akademikoa, Ekintzailetza Jarduera Akademikoa, Unibertsitate Ekintzailearen emaitzak, Unibertsitate - Enpresa Lankidetza, Jakintzaren Transferentzia eta Spin-off.

RESUMEN

La universidad es una institución con una larga historia y, en el transcurso de los siglos, ha pasado por varias etapas (Martinelli et al., 2008). Aunque fue concebida inicialmente como una institución que tenía la enseñanza como única "misión", la universidad más tarde adoptó la función de generación de conocimiento (investigación); adquiriendo una "segunda misión". Además, en los últimos años, ha surgido la idea de que la universidad ha adquirido una "tercera misión", contribuyendo a la sociedad y al desarrollo económico de manera más directa; convirtiendo la universidad en una Universidad Emprendedora. Pero, ¿qué constituye esta Universidad Emprendedora?

Hay diversos puntos de vista sobre lo que constituye una Universidad Emprendedora, pero todavía existe una falta de consenso sobre sus componentes principales (Rothaermel et al., 2007, Guerrero and Urbano, 2010). De hecho, en los últimos años, la Universidad Emprendedora ha recibido una mayor atención por parte de los investigadores (O'Shea et al., 2004, Guerrero et al., 2011). En particular, hay algunos modelos teóricos, por ejemplo, Clark (1998), Sporn (2001), Etzkowitz (2004), O'Shea et al. (2007), Peterka (2008), Guerrero and Urbano (2010), Salamzadeh et al. (2011), Gibb (2012), European Commission (2012) and Mavi (2014), que se centran en la explicación del fenómeno de Universidad Emprendedora. Sin embargo, se sabe poco acerca de los factores que contribuyen a la aparición de esta universidad (Rothaermel et al., 2007, Guerrero et al., 2011). Existe una falta de investigaciones empíricas que analicen la influencia de estos factores, ofreciendo una gran oportunidad de hacer importantes contribuciones en este campo.

Por lo tanto, el objetivo principal de esta investigación es realizar un análisis empírico-institucional de los factores que afectan a la Universidad Emprendedora. Para ello, se ha desarrollado y testeado empíricamente un modelo de Universidad Emprendedora que analiza la influencia del entorno externo a la universidad, de las características internas de la propia universidad y de los mecanismos de apoyo para el emprendimiento sobre los resultados de la Universidad Emprendedora.

Con este objetivo en mente, esta tesis ha adoptado un enfoque cuantitativo. Por otra parte, la estrategia de investigación se ha basado en una encuesta y la unidad de análisis fue la propia universidad; específicamente, las universidades europeas que fomentaban la tercera misión de la universidad, el desarrollo económico y social.

PALABRAS CLAVE

Universidad Emprendedora, Emprendimiento Académico, Resultados de la Universidad Emprendedora, Actividades de Emprendimiento Académico, Cooperación Universidad - Empresa, Transferencia de Conocimiento y Spin-off.

ABSTRACT

The university is an institution with a long history and, over the course of the centuries, it has gone through several stages in its development (Martinelli et al., 2008). While initially conceived as an institution with a teaching 'mission', the university later adopted a knowledge generation function (research). In recent years, the idea has emerged that the university is assuming a 'third mission', contributing to society and economic development more directly; turning the university into an Entrepreneurial University. But, what constitutes this Entrepreneurial University?

There are several views on what constitutes an Entrepreneurial University, but there is still a lack of agreement about its core components (Rothaermel et al., 2007, Guerrero and Urbano, 2010). Indeed, in the last years, the domain Entrepreneurial University has received increased attention from scholars (O'Shea et al., 2004, Guerrero et al., 2011). In particular, there are some theoretical models, e.g. Clark (1998), Sporn (2001), Etzkowitz (2004), O'Shea et al. (2007), Peterka (2008), Guerrero and Urbano (2010), Salamzadeh et al. (2011), Gibb (2012), European Commission (2012) and Mavi (2014), which are focused on the explanation of the Entrepreneurial University phenomenon. However, little is known about the factors that contribute to the emergence of these Entrepreneurial University (Rothaermel et al., 2007, Guerrero et al., 2011). Moreover, there is a lack of empirical studies which analyse the influence of these factors (Yusof et al., 2012), offering a great opportunity to make important contributions in this field.

Thus, the main purpose of this research was to develop an empirical-institutional analysis of the factors that affects the Entrepreneurial University. That for, an Entrepreneurial University model was developed and empirically tested; analysing the influence of external environment factors, internal organisation factors and entrepreneurship support mechanisms on Entrepreneurial University's results.

With this objective in mind, this research study adopted a quantitative approach. Besides, the research strategy was based on a self-devised survey and the unit of analysis was the university itself; specifically, European universities that were fostering universities' third mission, the economic and social development.

KEY WORDS

Entrepreneurial University, Academic Entrepreneurship, Entrepreneurial University's results, Academic Entrepreneurship Activities, University Business Cooperation, Knowledge Transfer and Spin-off Firm Formation.

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Introduction

1. INTRODUCTION

1.1   RELEVANCE OF THE STUDY

At this time, that society is facing global challenges which extend well beyond the economy, innovation and entrepreneurship provide a way forward; building sustainable development, creating jobs, generating renewed economic growth and advancing human welfare (Volkmann et al., 2009).

Following in this vein, it is now generally accepted that innovation is the most important engine of long-term competitiveness, growth and employment (European Commission, 2001). For improving this system of innovation is critical the collaboration between industry, academia and government (Etzkowitz et al., 2000). The Triple Helix model states that the university can play an enhanced role in innovation in increasingly knowledge-based societies (Etzkowitz and Leydesdorff, 2000). Furthermore, universities are catalysts for the enhancement of employment opportunities for local industry, especially with regional and national governments viewing the high technology and knowledge-based sectors as a crucial source of direct and indirect employment opportunities (Klofsten and Jones-Evans, 2000).

In fact, universities contribute to the Research and Development (onwards, R&D) capability of an economy in different ways (Lazzeroni and Piccaluga, 2003), creating new knowledge from basic research, producing specialised human capital or transferring technology from academia to industry. Moreover, in recent years, policy-makers have become increasingly interested in boosting this last option via patenting, licensing, spin-off firm formation and University Business Cooperation (onwards, UBC) (Philpott et al., 2011). For achieving this new role, universities' have transformed their primary mission based on preservation and dissemination of knowledge, into a mission which has teaching, research and economic and social development as key factors, playing a major role in regional innovation and economic growth (Etzkowitz, 2003c). Thereby, any university that embraces its role within the triple helix model and adopts the third mission is referred to as an 'Entrepreneurial University' (Philpott et al., 2011).

In Europe, the Declaration of Bologna (1999), Lisbon (2000) and Brussels (2005) are clear examples of government interest in boosting the Entrepreneurial University; since, these European policies are strategically focused on reinforcing teaching, research and economic and social development (Kitagawa, 2006). Besides, networks such as the Finnish Entrepreneurship and Innovation Network for Higher Education (FINPIN), the University Industry Innovation Network (UIIN) and the Organisation for Economic Co-operation and Development (OECD) aim to

contribute to the development of the Entrepreneurial University, working on the transition from a traditional university to a more engaged and entrepreneurial one. Indeed, the latter one has designed a tool to help universities pursue the goal of becoming an Entrepreneurial University through a self-assessment process that also provides examples of inspiring projects that can be implemented.

In this line, in the recent years, many researchers have been trying to understand the most relevant factors within the Entrepreneurial University phenomenon (e.g. Clark (1998), Sporn (2001), Etzkowitz (2004) and Guerrero and Urbano (2010)); however, these is no consensus. There is nor a unified definition neither a set of characteristics that describe the Entrepreneurial University itself. Indeed, these studies identified some factors that characterise an Entrepreneurial University; however, in the last three years, new theoretical studies, such as Gibb (2012), have shown the importance of new factors related to the Entrepreneurial University phenomenon, raising further research on this subject.

Furthermore, due to the low number of empirical research on the Entrepreneurial University (Guerrero and Urbano, 2010, Markuerkiaga et al., 2014), a lack of both a referent model and a measuring scale are noticed (Aranha and Garcia, 2014). Due to this fact, on the one hand, it is necessary to expand the research topic and explore different entrepreneurship research streams[1], such as the corporate entrepreneurship, in order to find analogous models which can correspond with the Entrepreneurial University; and on the other hand, a deep analysis on different Entrepreneurial University's results, establishing some indicators to measure it.

In addition to the academic relevance of the study, it is important to highlight the interest of Mondragon University (onwards MU) in this thesis; since the main objective of MU is contributing to the transformation of the society it is located. Besides, one of its main characteristics is its close and permanent relationship with the working world, enabling to outline its educational offer by adapting it to the needs of companies and organisations. Therefore, the clarification of what an Entrepreneurial University is, including the factors that make it up, the indicators for measuring it and the relationship between both is necessary for it.

Last but not least, it is worth mentioning the thesis developed by Ganzarain (2006) which was the baseline of MU at the beginning of its path towards the Entrepreneurial University. Indeed, through her thesis different Entrepreneurial Universities were analysed and an Entrepreneurial University Model that encompasses both internal and contextual factors was designed. Therefore, this thesis goes a step further and in addition to develop and test empirically a current Entrepreneurial University's model, it analyses how a university could obtain better Entrepreneurial University's results.

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[1] Entrepreneurship can take many other shapes and forms than the "typical" business start-up, including social entrepreneurship, corporate entrepreneurship, serial/portfolio entrepreneurship, and rural entrepreneurship, among others.

1.2   TOWARDS THE ENTREPRENEURIAL UNIVERSITY

Most historians take the medieval universities of Bologna and Paris, as archetypes and the starting points for their account (Delanty, 2002). These were institutions of scholastic work and teaching, with no, or relatively little, practical knowledge taught. From these roots comes the original mission of the university to empower and train its students to intellectually participate in society.

Over time, more practical knowledge, such as law and medicine, was codified and offered at universities. Coinciding with the dawn of modernity, universities taught more and more students and the university became an institution to obtain vocational education. Indeed, in this period the state recognised universities' relevance as breeding ground for its bureaucrats, doctors and lawyers. Certification and the codification of "nationality" (e.g. history, geography, etc.) became an important role of the university and a close bond between the state and the university was built (Senges, 2007).

Universities' first mission was described as education for cultural and technological citizenship (Delanty, 2002). Whereby cultural citizenship includes all knowledge needed to actively participate in political, as well as social affairs, while technological citizenship comprises the abilities to create economic value (Delanty, 2002).

The second mission that most universities embraced was to do research. This new task was introduced by Wilhelm von Humboldt (1810) quoted in Senges (2007) in the late 19th century, at the occasion of the founding of the new university of Berlin. Spurred by the success of this model, research was added gradually to most universities.

Until recently, it was assumed that universities were guided solely by so-called "pure" academic criteria and had only these two missions: high-level research and transmission of knowledge (Laukkanen, 2003). Moreover, it was increasingly expected that universities, in addition to those basic tasks, play major roles in regional innovation and economic growth, often helping to turn around regions in distress. In this new division of labour, referred to as universities' third mission, academe was increasingly seen as a key provider of new technologies and business ventures, as a regional development engine. Thereby, after this second academic revolution, universities were transformed into Entrepreneurial Universities (Etzkowitz, 2003c) (see Table 1).

Table 1 Expansion of university mission (Etzkowitz, 2003c)

Teaching	*Research*	*Entrepreneurial*
Preservation and dissemination of knowledge	First academic revolution	Second academic revolution
New missions generate conflict of interest controversies	Two missions: teaching and research	Third mission: economic and social development; old missions continued

The assumption of this last role was the latest step in the evolution of the university from its original purpose of conservation of knowledge. Furthermore,

although universities became entrepreneurial, they did not give up their previous functions of teaching and disinterested research (Etzkowitz, 2003c). Indeed, the entrepreneurial characterisation implies the framing of universities as an opportunity seeking and exploiting institution (Shane and Venkataraman, 2000), which also relates to innovative approaches in the main academic areas of education and research (Bronstein and Reihlen, 2014).

1.3   PROBLEM STATEMENT AND PURPOSE OF THE RESEARCH

The university is an especially propitious site for innovation due to such basic features as its high rate of flow through human capital (Etzkowitz, 2003c). Even more, the university is a natural incubator; providing a support structure for teachers and students to initiate new ventures: intellectual, commercial and conjoint. Although it is evident that entrepreneurship within the university augurs well for the host institution and for its external environment (Meyers and Pruthi, 2011), what constitutes this Entrepreneurial University?

There are several views on what make up an Entrepreneurial University, however it still tends to be diverse and ambiguous (Kirby et al., 2011, Bronstein and Reihlen, 2014), contributing to a lack of agreement about its core components (Rothaermel et al., 2007, Guerrero et al., 2011). Furthermore, it seems that there is a need for changes in the traditional university in order to overcome real barriers within modern university structures and strategies (Etzkowitz, 2003a, Brennan et al., 2005); thereby, the dilemma facing university managers is how to engage with this phenomenon.

In the last years, the domain Entrepreneurial University has received increased attention from scholars (O'Shea et al., 2004, Guerrero et al., 2011) (see Figure 1). In particular, there are some theoretical models which are focused on the explanation of the Entrepreneurial University phenomenon (e.g. Clark (1998), Sporn (2001), Etzkowitz (2004), Kirby (2006), O'Shea et al. (2004), O'Shea et al. (2005), Guerrero et al. (2006), O'Shea et al. (2007), Rothaermel et al. (2007), Peterka (2008), Salamzadeh et al. (2011), Gibb (2012) and European Commission (2012)). However, little is known about the factors that make up the emergence of this Entrepreneurial University (Rothaermel et al., 2007, Guerrero et al., 2011); since, there is a lack of empirical studies which analyse the influence of these factors, offering a great opportunity to make important contributions in this field.

Figure 1 Evolution of publications on the Entrepreneurial University

From this basis, the main purpose of this thesis was to develop an empirical-institutional analysis of the factors that affects the Entrepreneurial University. Particularly the specific objectives were the following:

- To analyse the relationships between external environmental factors, internal organisational factors, entrepreneurship support mechanisms and Entrepreneurial University's results.

- To analyse the impact of each entrepreneurship support mechanisms on Entrepreneurial University's results.

- To develop a universities' taxonomy depending on Entrepreneurial University's results.

In order to achieve these objectives the present research adopted a quantitative approach, being the survey the research strategy and an emailed questionnaire the data collection method. For this aim, the research was developed from an institutional insight, becoming European universities into the unit of analysis.

1.4   STRUCTURE OF THE DOCUMENT

The present document is organised in eight chapters and it is structured in order to facilitate the readers' understanding (see Table 2). The first chapter deals with the introduction of the research, delving into the purpose of the study and its objectives. Then, through the second chapter the literature review is done, identifying the Entrepreneurial University's factors and analysing the Entrepreneurial University's results. Afterwards, the research framework which guided the empirical research is shown. Subsequently, Chapter 4 deals with the research design and methodology. Moving on to the next chapter, the results based on the collected data are analysed. And finally, the last three chapters deal with the conclusions, the bibliographic references and the annexes, consecutively.

Table 2 Structure of the thesis

	Description
Chapter 1: INTRODUCTION	Introduction to the present research, delving into the purpose of the study.
Chapter 2:LITERATURE REVIEW	Through this chapter the literature review regarding the Entrepreneurial University is done.
Chapter 3: RESEARCH FRAMEWORK	Chapter 3 shows the research framework which guides the empirical research.
Chapter 4: RESEARCH DESIGN AND METHODOLOGY	This fourth chapter discusses the research methodology, including the research strategies and tactics for achieving the main goal.
Chapter 5: DATA ANALYSIS AND RESEARCH RESULTS	Chapter 5 shows the results based on the analysis of the data collected.
Chapter 6: CONCLUSIONS AND RECOMMENDATIONS	Through this chapter the contributions of this thesis are submitted and future research suggested.
Chapter 7: REFERENCES	This chapter shows the references used within the whole research work.
Chapter 8: ANNEXES	The last chapter shows the survey used, the universities surveyed and the statistical results for a better understanding of what is stated in the document.

1.5   SUMMARY

This chapter established the basis of the present research, explaining and justifying the research problem, stressing the importance of the subject and introducing the research objectives. Afterwards, the key elements of the applied methodology were described and finally, the structure of the report was pointed out. From this baseline, the next chapters collect the detailed description of the research.

1.5   SUMMARY

Chapter 2
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Literature review

2. LITERATURE REVIEW

The identification and exploitation of entrepreneurial opportunities requires a supportive climate that promotes the drive for innovation and entrepreneurship in all members (Mueller, 2007). In this context, it is important to remember that the incorporation of an entrepreneurial orientation in all university's missions (Etzkowitz, 2004) and the promotion of some specific factors could boost this situation (Clark, 1998, Sporn, 2001, Etzkowitz, 2004, O'Shea et al., 2007, Guerrero and Urbano, 2010).

Thereby, the present chapter has a triple objective: first of all, to identify the factors that make up an Entrepreneurial University, then to analyse the different models in order to identify the relationships between these factors, and finally to review the Entrepreneurial University's results so as to establish a measurement scale. There was not a straight way to achieve these objectives, since the literature was stratified; thereby, papers which analysed the Entrepreneurial University through different research methodologies (e.g. reviews, case studies, theoretical models and empirical research) were used in order to identify all the factors and select the most cited ones (Markuerkiaga et al., 2014).

After analysing the main concepts regarding the Entrepreneurial University, specifically definitions, characteristics, different theoretical frameworks and empirical studies, research on spin-off formation was detected as the most empirically analysed stream related to the Entrepreneurial University. Although this term was only a small piece of the Entrepreneurial University (indeed, it is a specific Entrepreneurial University's result, see Section 2.4), a new field to become as an input was found.

Following in this vein, several authors, such as Di Gregorio and Shane (2003), O'Shea et al. (2004), Lockett et al. (2005), Landry et al. (2006), Gómez Gras et al. (2008), Fini et al. (2009), Van Looy et al. (2011) and Ebersberger and Pirhofer (2011), tried to identify why some universities were more propitious for the spin-off firm formation than others, highlighting the role of several factors as responsible for it. Due to these findings, the inclusion of these factors as possible Entrepreneurial University factors was essential for the present research.

Meanwhile, from the Entrepreneurial University's models review, the relationships between the factors were analysed in order to build the theoretical framework of the present thesis. In fact, in addition to Entrepreneurial University's models,

corporate entrepreneurship[2] models were also reviewed; since this perspective had the potential to understand better the organisational context, the institutional settings and the dynamic nature of the academic entrepreneurship phenomenon (Brennan et al., 2005, Brennan and McGowan, 2006, Clarysse et al., 2011, Wood, 2011, Yusof et al., 2012) (see Section 2.3).

Finally, different ways of measuring the Entrepreneurial University were analysed. Indeed, two different currents were detected for measuring the Entrepreneurial University: on the one hand, the ones who measured the factors that made up the Entrepreneurial University and on the other hand the ones who described a set of indicators for measuring the Entrepreneurial University (see Section 2.4.).

2.1   DEFINING THE ENTREPRENEURIAL UNIVERSITY

The term *"Entrepreneurial University"* was coined by Etzkowitz (1983) to describe instances in which universities proved themselves as critical to regional economic development (O'Shea et al., 2004). In this context, the Entrepreneurial University played an important role as both a knowledge-producer and a disseminating institution (Guerrero and Urbano, 2012).

In the literature, several definitions regarding the Entrepreneurial University were found. In fact, based on the literature review, a series of different definitions were drawn up (see Table 3 and Table 4).

Table 3 Review of Entrepreneurial University definitions (adapted from Gajon (2011))

Author (year)	Definition
Etzkowitz (1983)	"… are universities considering new sources of funds like patents, research under by contracts, and entry into partnerships with private enterprises"
Chrisman et al. (1995)	"… involves the creation of new business ventures by university professors, technicians, or students"
Dill (1995)	"… is defined as formal efforts to capitalize upon university research by bringing research outcomes to fruition as commercial ventures"
Röpke (1998)	"… can mean three things: (i) the university itself, as an organisation, becomes entrepreneurial; (ii) the members of the university – faculty, students, employees – are turning themselves somehow into entrepreneurs; and (iii) the interaction of the university with the environment, the structural coupling between university and region, follows an entrepreneurial pattern"
Clark (1998)	"… seeks to innovate in how it goes to business; seeks to work out a substantial shift in organisational character so as to arrive at a more promising posture for the future; and seeks to become "stand-up" universities that are significant actors in their own terms"

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[2] Corporate Entrepreneurship is the process by which individuals inside organisations pursue opportunities without regard to the resources they currently control Stevenson, H., Roberts, M. and Grousbeck, H. (1989) *New ventures and the entrepreneur,* .

Table 4 Review of Entrepreneurial University definitions (adapted from Gajon (2011)) (continuation)

Author (year)	Definition
Subotzky (1999)	"… is characterised by closer university-business partnerships, by greater faculty responsibility for accessing external sources of funding, and by a managerial ethos in institutional governance, leadership and planning"
Etzkowitz et al. (2000)	"…is any university that undertakes entrepreneurial activities with the objective of improving regional or national economic performance as well as the university's financial advantage and that of its faculty"
Kirby (2002)	"… has the ability to innovate, recognizes and creates opportunities, works in teams, takes risks and responds to challenges"
Etzkowitz (2003c)	"… trains individual students and sends them out into the world; being a natural incubator and providing support structures for teachers and students to initiate new ventures"
Jacob et al. (2003)	"… is based on both commercialization and commoditization (patents, licensing or student-owned start-ups)"
Tuunainen (2005)	"…is a new type of institution which is evolving as a result of the insensitive interaction between university, industry, and government and also integrates the economic development into the university as an academic function along with teaching and research"
Guerrero et al. (2006)	"… is a university that has the ability to innovate, recognize, and create opportunities, work in teams, take risks, and respond to challenges on its own; providing support structures for teachers and students to initiate new ventures"
Blenker et al. (2006)	"… is an institution which provides the basis for regional and national growth and development through close and intensive cooperation with its environment"
Benneworth (2007)	"… provides, through technology-transfer activities, new technological knowledge demanded by companies to create and exploit value for the global market"
Cargill (2007)	"… is the antithesis of the traditional `ivory tower' of learning, a much more economically and society-focused contributing to economic development through the creation of new opportunities and the support for starting new businesses"
Mohar and Kamal (2007)	"… is a university that strategically adapts the entrepreneurial mindset throughout the organisation and practices academic entrepreneurship which also encompasses technology transfer activities"
Guenther and Wagner (2008)	"… is a manifold institution with direct mechanisms to support the transfer of technology from academia to industry as well as indirect mechanisms in support of new business activities via entrepreneurship education"
Etzkowitz and Zhou (2008)	"…its heart is the contribution to innovation in economic and social development"
Bratianu and Stanciu (2010)	"… is a university that is consciously introducing new practices, it is innovative from the organisational, technological and financial point of view, is actively trying to innovate its activity, to operate important changes in its organisational structure, by opening more promising perspectives for the future, etc."
Mohar et al. (2010)	"… is a university that extensively practices academic entrepreneurship"
Philpott et al. (2011)	"… is any university that undertakes entrepreneurial activities"

After analysing these definitions, it could be concluded that all the definitions summarised the Entrepreneurial University through the following seven characteristics:

- Its ability to adapt adaptation to environmental changes (Clark, 1998).
- Its managerial and governance distinctiveness (Subotzky, 1999, Bratianu and Stanciu, 2010).
- Its ability to innovate, recognise and create opportunities (Guerrero et al., 2006).
- The new responsibilities of their members (Etzkowitz, 1983).
- The development of an entrepreneurial culture on all levels (Clark, 1998, Kirby, 2002, Etzkowitz, 2003c).
- Its close cooperation with its environment (Blenker et al., 2006).
- Its contribution to the economic and social development (Chrisman et al., 1995, Dill, 1995, Röpke, 1998, Etzkowitz et al., 2000, Jacob et al., 2003, Benneworth, 2007, Cargill, 2007, Mohar and Kamal, 2007, Guenther and Wagner, 2008, Mohar et al., 2010, Philpott et al., 2011).

In this vein, although there was no consensus about the use of one specific definition; some authors state that an Entrepreneurial University was a set of characteristics that within together conforms this phenomenon (Gibb, 2012). Thereby, authors such as Sporn (2001), Clark (2004), Yokoyama (2006), Gibb et al. (2009), Bratianu and Stanciu (2010) and Meyer (2011), identified the most important characteristics that describe an Entrepreneurial University (see Table 5 and Table 6).

Table 5 Review of the characteristics of the Entrepreneurial University

AUTHOR	CHARACTERISTICS
Röpke (1998)	- The university itself has to become entrepreneurial. - The university's members (faculty, students and employees) have to be turning themselves somehow into entrepreneurs. - The interaction of the university with the environment has to follow entrepreneurial patterns.
Sporn (2001)	- Environment: Adaptation at universities is triggered by environmental demands which can be defined as crisis or opportunity by the institution. - Mission, goals: In order to adapt, universities need to develop clear mission statements and goals. - Culture: An entrepreneurial culture enhances the adaptive capacity of universities. - Structure: A differentiated structure enhances adaptation at universities. - Management: Professionalized university management helps adaptation. - Governance: Shared governance is necessary to implement strategies. - Leadership: It is an essential element for successful adaptation.
Clark (2004) and Clark (1998)	- A strong central steering core to embrace management groups and academics. - An expanded development periphery, involving a growth of units that reach out beyond the traditional areas in the university. - Diversity in the funding base, not only by use of government third stream funding but from a wide variety of sources. - A stimulated academic heartland with academics committed to the entrepreneurial concept. - An integrated entrepreneurial culture.

Table 6 Review of the characteristics of the Entrepreneurial University (continuation)

AUTHOR	CHARACTERISTICS
Yokoyama (2006)	- The extension of entrepreneurial activities - The notion of a gap between market-oriented policy and reality - The conflict between academic and entrepreneurial values - The introduction of managerialism
Gibb et al. (2009)	- Entrepreneurial leadership with widely shared commitment to innovation and management of interdependency with all stakeholders. - Maximising autonomy and individual ownership of initiatives. - Wide encouragement for staff to develop and "own" external relationships. - Delegated responsibility to see things through. - Allowing overlap and informal integration within and without the organisation. - Encouraging and rewarding learning by doing and from stakeholders. - Flexible strategic thinking as opposed to highly formal planning.
Bratianu and Stanciu (2010)	- Strong decision organism in the centre of the Entrepreneurial University. - Well-endowed from a technological point of view, having competent specialists who are receptive to new elements and able to tackle new research themes. - Governed by decentralization and delegation, they are flexible and quick in their research process and educational offer. - Significant financial resources. - Able to bear the fluctuations of the external environment. - Able to make solid connections with entities from the external environment. - Promotes that state of mind which leads to accepting changes.
Meyer (2011)	- Top-down vision, strategy and leadership. - Clearly defined entrepreneurship learning. - Objectives that drive the curriculum. - Robust internal and external networks. - A culture of innovation. - Experiential learning. - Knowledge transfer opportunities.
Pinheiro and Stensaker (2013)	- Tight coupling: a) internally (sub-units); b) externally (links with society). - Executive: strong steering core (central & unit levels). - Coherent institutional profile & unitary organisational identity. - Social relevance & third stream funding. - Teaching, research & third mission. - Strategic science (Mode-2 knowledge production & user-inspired basic research).

According to all these researchers, an Entrepreneurship University is described through the following set of characteristics:

- It has an integrated entrepreneurial culture (Clark, 1998, Röpke, 1998, Sporn, 2001, Clark, 2004, Gibb et al., 2009, Bratianu and Stanciu, 2010, Meyer, 2011).
- Its members are turned into entrepreneurs (Clark, 1998, Röpke, 1998, Clark, 2004).
- It has a strong interaction with its environment, developing external relationships (Röpke, 1998, Sporn, 2001, Gibb et al., 2009, Bratianu and Stanciu, 2010, Pinheiro and Stensaker, 2013).
- It has diversity in its funding base (Clark, 1998, Clark, 2004).
- Its mission, goals, structure, governance and management are defined to be adaptive to the environment fluctuations (Sporn, 2001, Bratianu and Stanciu, 2010, Meyer, 2011).
- It contributes to the economic and social development (Yokoyama, 2006, Meyer, 2011).

2.2   ENTREPRENEURIAL UNIVERSITY FRAMEWORKS

Other source for identifying Entrepreneurial University factors was the review of theoretical studies on this specific subject; although, there was not much literature related to it. A deep review of Entrepreneurial Universities' frameworks was done and thirteen frameworks which try to explain this phenomenon were identified: Clark (1998), Sporn (2001), Etzkowitz (2004), Kirby (2006), Guerrero et al. (2006), Wong et al. (2007), Teh and Yong (2008), Peterka (2008), Hindle (2010), Salamzadeh et al. (2011), Gibb (2012), European Commission (2012) and Mavi (2014).

Therefore, through the following lines, all these frameworks are described one by one, identifying the factors they take into account.

Clark (1998): The pioneering researcher in identifying the core elements of an Entrepreneurial University was Clark (1998). He analysed how five universities in five different European countries changed their character to become Entrepreneurial Universities. Indeed, he identified five different elements which constitute an irreducible minimum for transforming themselves. These five elements were: (i) a strength steering core, (ii) an expanded developmental periphery, (iii) a diversified funding base, (iv) a stimulated academic heartland and (v) an integrated entrepreneurial culture.

Sporn (2001): After Clark (1998) leading approach, Sporn (2001) through her paper presented empirical results (specifically a case study) from a cross-national study of Entrepreneurial University structures. Based upon that, new organisational forms were introduced which support better and enhance the current trend towards the Entrepreneurial University. Table 7 shows the most critical factors identified by Sporn (2001) which foster this transformation.

Table 7 Most critical factors for the adaptation of universities by Sporn (2001)

Factor	Description
Environment	Adaptation at universities is triggered by environmental demands which can be defined as crisis or opportunity by the institution.
Mission, goals	In order to adapt, universities need to develop clear mission statements and goals.
Culture	An entrepreneurial culture enhances the adaptive capacity of universities.
Structure	A differentiated structure enhances adaptation at universities.
Management	Professionalized university management helps adaptation.
Governance	Shared governance is necessary to implement strategies of adaptation.
Leadership	Committed leadership is an essential element for successful adaptation.

Etzkowitz (2004): Later on, Etzkowitz (2004) expressed the Entrepreneurial University in a set of inter-related propositions: Capitalisation, Interdependence, Independence, Hybridisation and Reflexivity (CIIHR). Moreover, he stated that the optimum Entrepreneurial University format resides in a balance among these five elements. In Table 8 each factor is described more in detail.

Table 8 Entrepreneurial University's five elements by Etzkowitz (2004)

Factor	Description
Capitalisation	Knowledge created and transmitted for use as well as for disciplinary advance; the capitalisation of knowledge becomes the basis for economic and social development and, thus, of an enhanced role for the university in society.
Interdependence	The Entrepreneurial University interacts closely with the industry and government; it is not an ivory tower university isolated from society.
Independence	The entrepreneurial university is a relatively independent institution.
Hybridisation	The resolution of the tensions between the principle of interdependence and independence are an impetus to the creation of hybrid organisational formats to realise both objectives simultaneously.
Reflexivity	There is a continuing renovation of the internal structure of university as its relation to industry and government changes, and of industry and government as their relationship to the university is revised.

Kirby (2006): In 2006, Kirby (2006) through a case study research, based on the University of Surrey, showed different strategic factors intended to promote entrepreneurship activities within the university. In order to achieve this, he formulated a high-level strategy that demonstrates the university's intent, makes it clear that the university encourages this form of behaviour, provides the university's staff with the knowledge and support to start their own businesses and creates an environment that reduces the risk involved. The sort of factors involved in such a strategy is shown in Table 9.

Table 9 Factors involved into entrepreneurship activities' promotion by Kirby (2006)

Factor	Description
Endorsement	Senior staff acts as role models.
Incorporation	Into University, Faculty/Departmental and personal plans.
Implementation	Setting targets that are monitored.
Communication	Publication & dissemination of the strategy and consultation on it.
Encouragement and support	- Hard support—enterprise laboratories, pre-incubators, incubators, science parks, meeting rooms, computing support, office support services and seed corn funding - Soft support—training, mentoring and advice, signposting to sources of external support, on-going technical and management support once the venture is launched
Recognition and reward	Equity sharing, promotion, etc.
Organisation	Cross-disciplinary research and teaching groups, educational partnerships, a multi-disciplinary Entrepreneurship Centre.
Promotion	Business plan competitions, entrepreneurship ''halls of fame'', cases, role models, etc.

Guerrero et al. (2006): The same year Guerrero et al. (2006) started researching in Entrepreneurial Universities. For building their framework they adopted the Institutional Economics and Resource Based View, focusing on internal factors (resources and capabilities) and environmental factors (formal and informal) that facilitate or retard the phenomenon of an Entrepreneurial University. These factors consist of different variables; on the one hand, the formal actors include university organisational structure and university government, support measures to university spin-offs and university entrepreneurship education programmes and courses; and on the other hand, informal factors include university attitudes to entrepreneurship, entrepreneurship programmes, and role models (see Table 10).

Table 10 Entrepreneurial University models factors by Guerrero et al. (2006)

Environmental	**Formal**	- entrepreneurial organisational and governance structure - support measures for entrepreneurship - entrepreneurship education
	Informal	- university community's attitudes towards entrepreneurship - entrepreneurial teaching methodologies - role models and reward system
Internal	**Resources**	- human capital - financial - physical - commercial
	Capabilities	- status and prestige - networks and alliances - localisation

Wong et al. (2007): In 2007 policy makers charted a course for Singapore's transition from an investment-driven economy to an innovation-driven economy, emphasizing the building of intellectual capital and its commercialisation to create value and jobs. Therefore, Wong et al. (2007) identified the key elements that made up an Entrepreneurial University (see Figure 2) and examined how the National University of Singapore changed its role in Singapore.
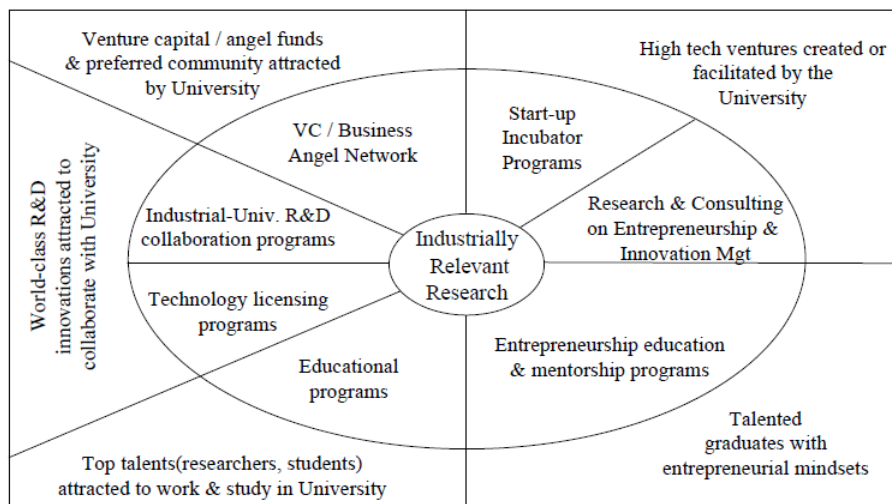
Figure 2 Key elements of Entrepreneurship University Model by Wong et al. (2007)

Teh and Yong (2008): Based on Guerrero et al. (2006), Teh and Yong (2008) developed a university-push approach as an example of the Entrepreneurial University. The framework consists of four formal factors and four informal factors (see Figure 3). Their approach was mainly focused on the formal factors; due to its purpose to highlight the underestimated entrepreneurship activities and to discuss the implications of the university's management policies and formal university programs in order to foster such activities.
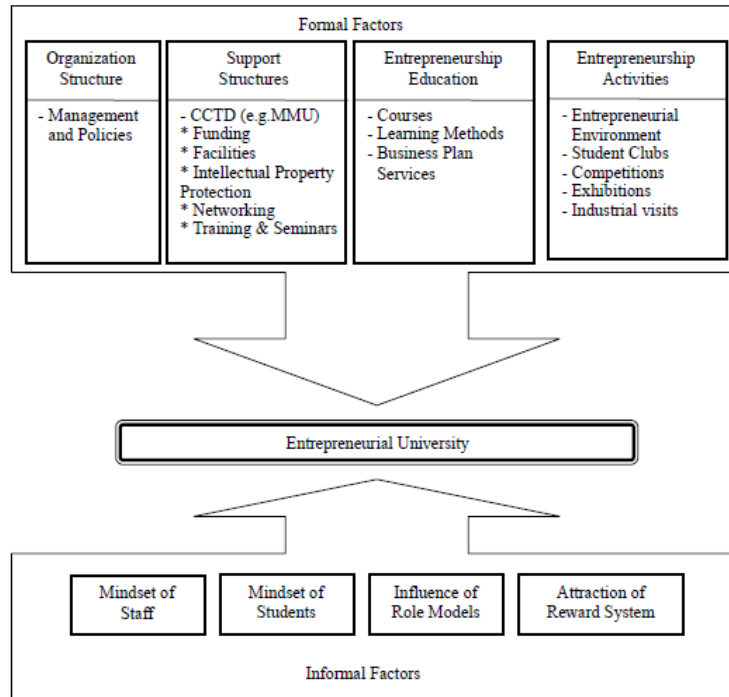
Figure 3 Conceptual framework for the model of Entrepreneurial University by Teh and Yong (2008)

Peterka (2008): Peterka (2008) built her Entrepreneurial University framework based on a systematic approach, which connected all parts of the system; in the model of Entrepreneurial University this meant mutual connection of each component and value determinant, and openness towards the environment. The framework consisted of four basic elements, two value components and a system of connections between basic elements and value components (see Table 11).

Table 11 Entrepreneurial University elements by Peterka (2008)

Value components	- Responsibility and autonomy of university are two inseparable characteristics of entrepreneurial university; through responsible behaviour towards environment university obtains the right to autonomy in performing of its activity. - Integrated entrepreneurial culture presumes high integration of all university elements around the value dimensions of entrepreneurship (proactivity, innovativeness, readiness to assume risk), and high decentralization of university on the principle of subsidiarity in reacting to changes in the environment.
Basic Elements	- The Entrepreneurial University core which consists of university components which perform the basic research and education functions (e.g., faculties, departments...), and supra-organisational structure of integrated university. - A developed university periphery that is represented by university's interdisciplinary. - A strong (collegial) leadership; it is essential in the process of university transformation. - Diversified financing of university, which means creation of financially independent (on state sources of financing) university as an important prerequisite for creation of entrepreneurial university.

Hindle (2010): Hindle (2010) also developed his own framework that categorised the functions of the Entrepreneurial University into the following four overlapping dimensions: (i) teaching and research, (ii) entrepreneurship education programs, (iii) technology transfer and (iv) organisational management (see Figure 4). The framework held that the main objective of the Entrepreneurial University was to

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create a continuous stream of innovation. In his context, innovation was understood as the successful commercialisation of new ideas or inventions, and entrepreneurship was simply defined as the engine of this value creating process and was not limited to the formation of new ventures. Thus, entrepreneurial behaviour within the teaching and research dimension might produce valuable socioeconomic outcomes in the forms of new innovative programmes and research.
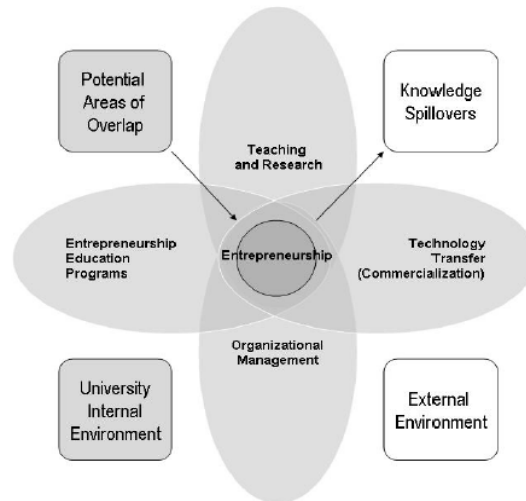
Figure 4 Four dimensions of the entrepreneurial university by Hindle (2010)

Salamzadeh et al. (2011): Salamzadeh et al. (2011) developed a framework for Entrepreneurial Universities based on a dynamic system; which included special inputs, processes, outputs and aims to mobilised all of its resources, abilities and capabilities in order to fulfil its third mission (see Table 12).

Table 12 Systematic Framework for Entrepreneurial Universities by Salamzadeh et al. (2011)

	Factors
Inputs	Resources, Culture, Rules and regulations, Structure, Mission, Entrepreneurial capabilities, and Expectations of the society, industry, government and market
Process	Teaching, Research, Managerial processes, Logistical processes, Commercialization, Selection, Funding and financial processes, Networking, Multilateral interaction, and Innovation, research and development activities
Outputs	Entrepreneur human resources, Effective researches in line with the market needs, Innovations and inventions, Entrepreneurial networks, and Entrepreneurial centres
Outcome	Third mission

Gibb (2012): Gibb (2012) developed a theoretical framework (see Figure 5) for the exploration of a strategic approach to the Entrepreneurial University development, looking at the opportunities for reating strategic and operational synergies between various entrepreneurial activities undertaken by universities as a basis for building a 'real time' entrepreneurial development strategy. Indeed, the key areas analysed by Gibb (2012) were: (i) mission, governance and strategy, (ii) stakeholders engagement, (iii) entrepreneurship education, (iv) internationalisation and (v) knowledge transfer, exchange and support.
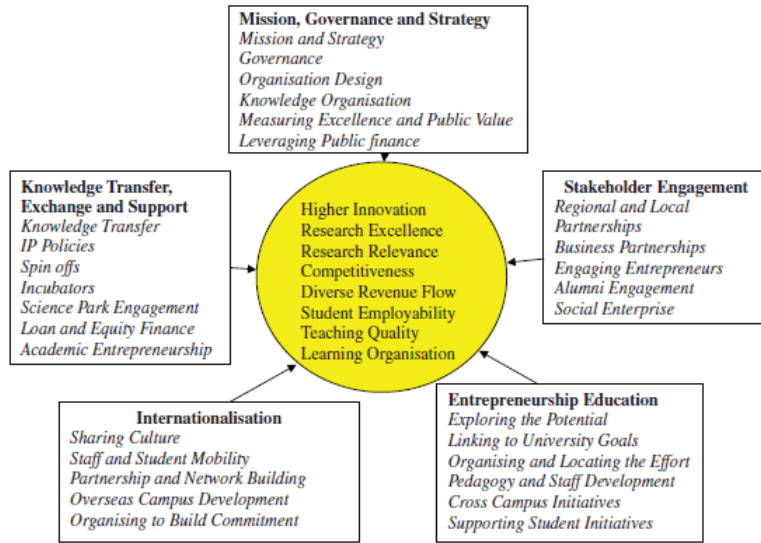
Figure 5 Review of the Entrepreneurial University factors by Gibb (2012)

European Commission (2012): In 2012 the 'Guiding Framework for Entrepreneurial Universities' was developed jointly by the OECD LEED Programme and the European Commission (European Commission, 2012). This framework was based on international case study work on university entrepreneurship support and the theoretical debate on the role of universities in generating entrepreneurial motivations, intentions and competences (see Figure 6). It was designed to help interested universities to assess themselves against statements organised under seven broad topics.
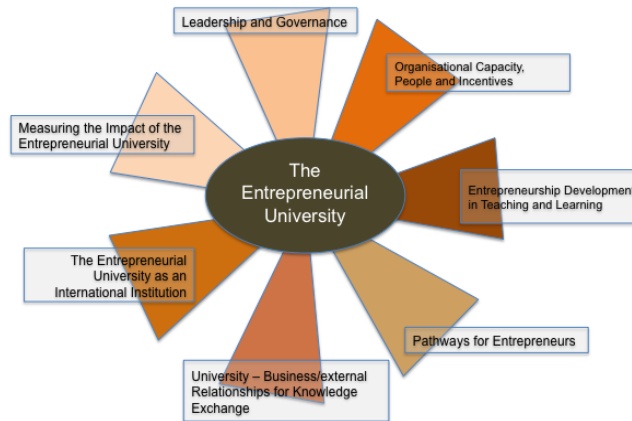
Figure 6 Guiding framework for Entrepreneurial Universities by European Commission (2012)

Mavi (2014): Finally, Mavi (2014) summarised the Entrepreneurial University criteria as it is shown in Table 13. He provided a comprehensive criteria set for evaluation of Entrepreneurial Universities. Twelve academics and managers have participated in his study by weighing the criteria and scoring alternatives.

Table 13 Effective criteria of entrepreneurial university by Mavi (2014)

Environmental factors		Internal factors	
Formal	*Informal*	*Resources*	*Capabilities*
Entrepreneurial organisational and governance structure	University community's attitudes towards entrepreneurship	Human capital	Status and prestige
Support measures for entrepreneurship	Entrepreneurial teaching methodologies	Financial	Networks and alliances
Entrepreneurship education	Role models and reward system	Physical	Localisation
Work discretion/autonomy	Unconventionality	Commercial	
Industry collaboration	Entrepreneurial culture		
Sustainability considerations			

Through the review of each of these thirteen Entrepreneurial University frameworks, the factors used in each research study were identified (see Table 14).This review clearly showed that according to their citation frequency all the factors could be classified into three groups. The first group encompassed the most cited factor, with presence in nearly all the frameworks. The next group included the seven factors that appeared in half of the frameworks; and, finally, the last group was composed of the six factors that appeared least frequently among the analysed frameworks.

Table 14 Review of the Entrepreneurial University factors

	Clark (1998)	*Sporn (2001)*	*Etzkowitz (2004)*	*Kirby (2006)*	*Guerrero et al. (2006)*	*Wong et al. (2007)*	*Teh and Yong (2008)*	*Peterka (2008)*	*Hindle (2010)*	*Salamzadeh et al. (2011)*	*Gibb (2012)*	*European Commission (2012)*	*Mavi (2014)*	*Total*
Mission and strategy	x	x	x	x	x			x	x	x	x		x	10
Entrepreneurship education					x	x	x	x	x		x	x	x	8
Teaching methodologies				x	x		x				x	x	x	6
Governance structure					x		x			x	x	x	x	6
External environment	x	x							x		x	x	x	6
Reward system				x	x		x	x				x	x	6
Leveraging finance	x						x	x		x	x		x	6
University business cooperation			x		x	x					x	x	x	6
Role models				x	x		x	x					x	5
Entrepreneurship support measures (incubators, science parks, etc.)				x	x	x		x			x			5
Organisational design							x				x	x	x	4
Resources: human, financial, physical and commercial					x					x			x	3
Policies & laws							x			x	x			3
Staff development in entrepreneurship											x	x		2
Internationalisation											x	x		2

Thus, at first sight this analysis showed that (i) mission and strategy, (ii) entrepreneurship education, (iii) teaching methodologies, (iv) governance structure, (v) external environment, (vi) rewards, (vii) levering finance and (viii) university business cooperation were the most cited factors obtained from Entrepreneurial University's frameworks.

2.3 ENTREPRENEURIAL UNIVERSITY MODELS AND EMPIRICAL STUDIES

After analysing the different Entrepreneurial University's frameworks, a review of Entrepreneurial University's models and empirical studies was done following a double objective: on the one hand, to continue identifying the factors that made up an Entrepreneurial University and on the other hand, to analyse which were the relationships between these factors.

In order to achieve the first objective, the identification of the factors that made up the Entrepreneurial University, the analysis of empirical studies on spin-off firm formation was identified as another important source; since the spin-off firm formation was the most studied Entrepreneurial University's result. During the last twenty years many authors, such as Di Gregorio and Shane (2003), O'Shea et al. (2004), Grandi and Grimaldi (2005), Lockett et al. (2005), Landry et al. (2006), Gómez Gras et al. (2008), Fini et al. (2009), Van Looy et al. (2011) and Ebersberger and Pirhofer (2011), analysed the influence of university level factors which fostered the spin-off firm formation within the academic institution; ranging from institutional support (e.g. government laws, financial and non-financial incentives, etc.), local context characteristics (e.g. venture capital availability, entrepreneurial support mechanisms, science parks, proximity to universities, opportunities offered by industrial sectors, etc.), university's internal characteristics (e.g. mission, governance, strategy, etc.), university's entrepreneurship support mechanisms (e.g. knowledge and technology transfer regulations, reward system, business plan competitions, university business incubators, etc.) and entrepreneurship education (e.g. entrepreneurship education programmes, etc.). At first sight, due to the previous factors classification, it was noticed that some of these factors were already identified through the Entrepreneurial Universities theoretical models review. However, there were other factors which were not still considered.

For example, some studies showed that the size of the technology transfer office (O'Shea et al., 2005), age of the technology transfer office (Powers and McDougall, 2005), size of federal funding in science and engineering (Shane, 2004b, Powers and McDougall, 2005), level of industry R&D funding (Powers and McDougall, 2005), availability of venture capital (Druilhe and Garnsey, 2004, Powers and McDougall, 2005), strength of patent protection (Shane, 2002), university rewards systems (Franklin et al., 2001), universities' intellectual property (Goldfarb et al., 2001), official university policy toward spin-offs (Roberts and Malone, 1996) and government policies (Shane, 2004b), among others, influence the promotion of spin-off firm formation.

On this basis, a careful review on studies related to spin-off firm formation was done in order to identify the most cited factors. In Table 15 and Table 16 all the identified factors are collected.

Table 15 Review of Academic Entrepreneurship factors I

	Di Gregorio and Shane (2003)	Lockett and Wright (2005)	Grandi and Grimaldi (2005)	Landry et al. (2006)	Rothaermel et al. (2007)	(Gómez Gras et al, 2008)	Fini et al. (2009)	Prodan and Drnovsek (2010)	Van Looy et al. (2003)	O'Shea et al. (2004)	Hsu et al. (2007)
Industry characteristics					x						
Government policies					x						
Sector opportunity for commercial exploitation							x				
Supportive institutional context							x				
State funding										x	
Regional infrastructure											
Local economic texture							x				
Technology transfer strategies					x	x				x	
Entrepreneurial universities' mission											
Governance Structure					x						
Laws & Policies			x								
Rules & Regulations	x		x	x			x			x	
Reward / incentive systems		x	x		x						
University status					x						x
University alliances										x	
Role Models							x	x			
University Culture					x						
Commercially-oriented research	x										
Research founds							x				
Research grants							x			x	
Research fields			x	x							
Novelty of research funding				x							
Leadership										x	
University research size				x							
Support for technology transfer									x		
Science park engagement					x						
Incubator engagement	x		x		x		x				
Entrepreneurship courses for students											
Entrepreneurship courses for academics											
Teaching Methodologies										x	
Human resources					x					x	
Commercial resources										x	
Informational resources										x	
Technology transfer office (TTO)					x	x	x			x	
Experience of TTO						x				x	
TTO staff dedicated to spin-off support						x					
TTO Efficiency											
Total TTO staff	x						x				
Business plan competition								x			
Access to academic infrastructures							x			x	
Availability of Venture Capital Funds	x		x								
Supplementary management education											
Entrepreneurship Educational Programs											
Entrepreneurial Boot Camps											

Table 16 Review of Academic Entrepreneurship factors II

	Kirby et al. (2011)	Todorovic et al. (2011)	Clarysse et al. (2011)	Haeussler and Colyvas (2011)	Van Looy et al. (2011)	Ebersberger and Pirhofer (2011)	Grimaldi et al. (2011)	Aldridge and Audretsch (2011)	Guerrero and Urbano (2010)	Heinzl et al. (2012)
Industry characteristics										
Government policies							x			
Sector opportunity for commercial exploitation										
Supportive institutional context							x			
State funding	x									
Regional infrastructure					x					
Local economic texture										x
Technology transfer strategies							x		x	
Entrepreneurial universities' mission									x	
Governance Structure	x									
Laws & Policies		x								
Rules & Regulations	x									
Reward / incentive systems	x									
University status									x	
University alliances										
Role Models	x									
University Culture										
Commercially-oriented research					x					
Research founds										
Research grants										
Research fields										x
Novelty of research funding					x					
Leadership										
University research size				x						
Support for technology transfer										
Science park Engagement	x									
Incubator engagement	x						x			
Entrepreneurship courses for students	x									
Entrepreneurship courses for academics	x							x		
Teaching Methodologies	x									x
Human resources									x	
Levering Finance										
Commercial resources										
Informational resources										
Technology transfer office (TTO)			x				x	x		
Experience of TTO					x					
TTO staff dedicated to spin-off support										
TTO Efficiency			x							
Total TTO staff										
Business plan competition							x			
Access to academic infrastructures										
Availability of Venture Capital Funds	x						x			
Supplementary management education						x				
Entrepreneurship Educational Programs							x			
Entrepreneurial Boot Camps							x			

Once analysed the previous research studies, in Table 17 it is shown the ranking of the most cited factors mentioned within them. At first sight, it seems that the factors measured within this research stream were predominantly operational factors, such as: the existence of a TTO, policies and laws and access to the

incubator, among others; although, there was also the presence of some strategic level factors, such as technology transfer strategies.

Table 17 Ranking of factors for spin-off firm formation

	Total citations
Technology transfer office (TTO)	7
Laws & Policies	6
Incubator engagement / Access to incubator	6
Technology transfer strategies	5
Rules & Regulations (e.g. IP, spin-off, patent, licenses)	4
Availability of Venture Capital	4
Reward / incentive systems	3
Experience of TTO	3
Teaching Methodologies	3

Moving on to the second objective established for the present section which dealt with the analysis of Entrepreneurial University's models to identify the relationships between the factors, only two Entrepreneurial University's model were identified; reinforcing the findings made by Brennan and McGowan (2006), who searching for suitable model of entrepreneurship in a university setting identified the lack of attention given to the organisational context within which such activity takes place. Indeed, Brennan and McGowan (2006) suggested that the ongoing debate concerning the expansion of university mission beyond teaching and research, to economic and social development (Etzkowitz, 2003c) need for a corporate view of entrepreneurship within a university setting.

The corporate entrepreneurship perspective was preferred because it offered an alternative to the traditional perspective of entrepreneurship that was centred on the role of the individual and the sequential stages of organisational development as posited by organisational life cycle theory (Yusof et al., 2012). Furthermore, this perspective had the potential to understand better the organisational context, the institutional settings and the dynamic nature of the academic entrepreneurship phenomenon (Brennan et al., 2005, Brennan and McGowan, 2006, Clarysse et al., 2011, Wood, 2011, Yusof et al., 2012).

The corporate entrepreneurship was consolidated as a research line when several authors, such as Burgelman (1983), Guth and Ginsberg (1990), Covin and Slevin (1991) and Hornsby et al. (1993), implemented diverse models joining various concepts and their relationship (Bieto, 2008). These models became into a frame of reference to analyse and describe the phenomenon, seeking to categorise the corporate entrepreneurship on descriptive variables and relationships between them. Moreover, in recent years, a variety of new frameworks (e.g. Lumpkin and Dess (1996), Russell (1999), Ireland et al. (2006a), Ireland et al. (2006b), McFadzean et al. (2005), Zehir and Eren (2007) and Bhardwaj et al. (2007)) were developed to validate the understanding of corporate entrepreneurship (Nyanjom, 2007).

In the following lines, the two Entrepreneurial University models and the main corporate entrepreneurship models (the four baseline models (Nyanjom, 2007))

are presented in order to identify the most appropriate one for the present research.

Guerrero and Urbano (2010): Based on their previous framework (Guerrero et al., 2006), Guerrero and Urbano (2010) developed and tested an Entrepreneurial University's model adopting the Institutional Economics and Resource Based View, focusing on internal factors (resources and capabilities) and environmental factors (formal and informal) that facilitate or retard the phenomenon of an Entrepreneurial University (see Figure 7).

Environmental Formal Factors
- Entrepreneurship courses for students and academics
- Support for technology transfer
- Support measures for start-ups
- Science Park
- Minimal regulations for new venture creation
- Not economical supports

Environmental Informal Factors
- Favourable student attitudes
- Favourable academic attitudes
- Entrepreneurship role models
- Appropriate reward system
- Entrepreneurial Teaching Methodologies

Internal Factors - Resources
- Human resources
- Financial resources
- Physical resources
- Commercial resources

Internal Factors - Capabilities
- University history
- University status
- University alliances
- University localization

Teaching
- Generation of job seekers
- Generation of entrepreneurs

Research
- Publishing scientific papers
- Publishing Papers with practical implications
- Knowledge transfer (patents, licenses, contracts)

Entrepreneurial activities
- Promotion of entrepreneurial culture
- Contribution to regional development

OUTCOMES

Figure 7 Model of Entrepreneurial Universities by Guerrero and Urbano (2010)

In this study, the Structural Equation Modeling offered results regarding the causal relationships among the variables that integrate the proposal model of entrepreneurial universities. Indeed, the analysis showed that academics considered that Entrepreneurial Universities were focused on fulfilling the teaching, research and entrepreneurial missions simultaneously. Particularly, the higher rated were the activities related with the transference of knowledge, the promotion of an entrepreneurial culture, and the contribution to the regional development.

Peterka (2011): In 2011, Peterka (2011) built her Entrepreneurial University model based on a systematic approach, which connected on all parts of the system; in the Entrepreneurial University model this meant mutual connection of each component and value determinant, and openness towards the environment. Thus, the Entrepreneurial University core influenced the development of university periphery, which created opportunities for additional sources of financing for the

university; precondition for successful implementation of such interactions was the existence of strong collegial leadership at the university (see Figure 8).
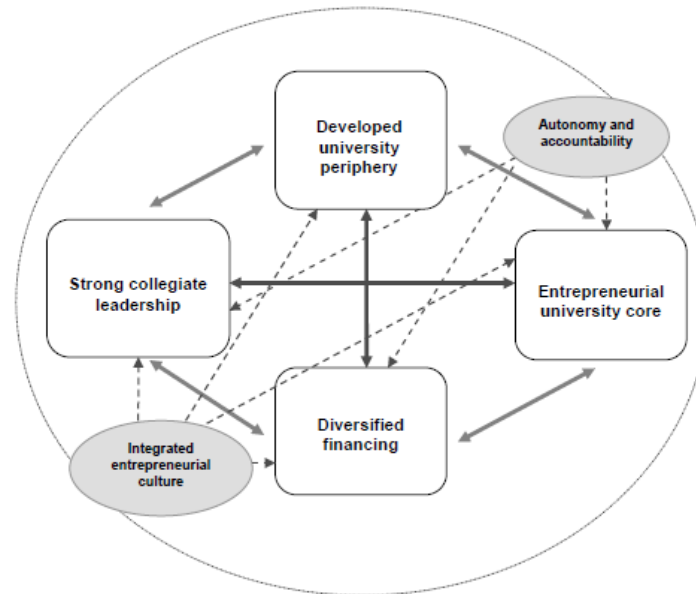
Figure 8 Model of Entrepreneurial University developed by Peterka (2011)

In order to test the model, a single case study was developed in the J.J. Strossmayer University; conducting ten interviews (six deans, two vice-deans, one head of university department and one vice-rector) and several surveys (to thirty-five university employees and to 364 university students).

Burgelman (1983): Burgelman (1983) proposed an inductively derived model of the dynamic interactions between different categories of strategic behaviour, corporate context processes, and a firm's concept strategy. This model could be used to elucidate the nature and the role of corporate entrepreneurship. In this model, the current concept of strategy represents the more or less explicit articulation of firm's theory about the basis for its past and current successes and failures. It provided a more or less shared frame of reference for the strategic actors in the organisation, and provided the basis for corporate objective-setting in terms of its business portfolio and resource allocation.

Guth and Ginsberg (1990): In 1990, Guth and Ginsberg (1990) presented a model that developed the knowledge of corporate entrepreneurship as embracing two perspectives and processes which surround them (see Figure 9). The first activity was regarding new businesses creation in established companies which involved internal innovations or venturing; and the second was regarding the transformation of the organisation through strategic renewal. The premise behind this model was that large firms need to adapt to an ever changing environment and to do so, they needed to adapt their structures and cultures as a means to encouraging entrepreneurial activity within the organisation. Consequently, the

key components were drawn from the environment, strategic leaders, organisation form and performance. It was seen that these components were interactive and important in determining the outcomes of entrepreneurship.
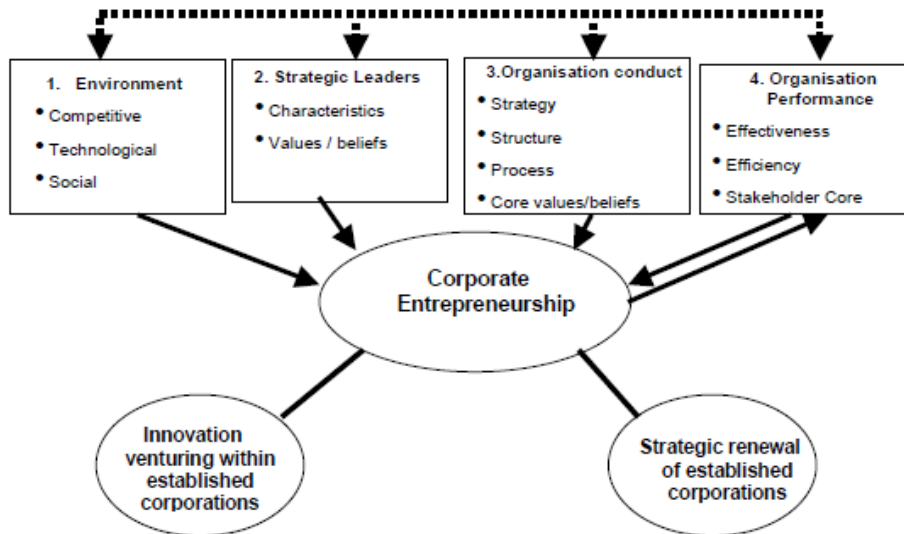
Figure 9 A strategic management perspective model of CE by Guth and Ginsberg (1990)

Covin and Slevin (1991): Afterwards, Covin and Slevin (1991) conceptualised entrepreneurship as an organisational level phenomenon. It dealt with the extension of the firms' domain of competence and corresponding opportunity set through internally generated new resources. These new resources were seen to emanate from external variables, strategic variables and internal variables as shown in Figure 10.
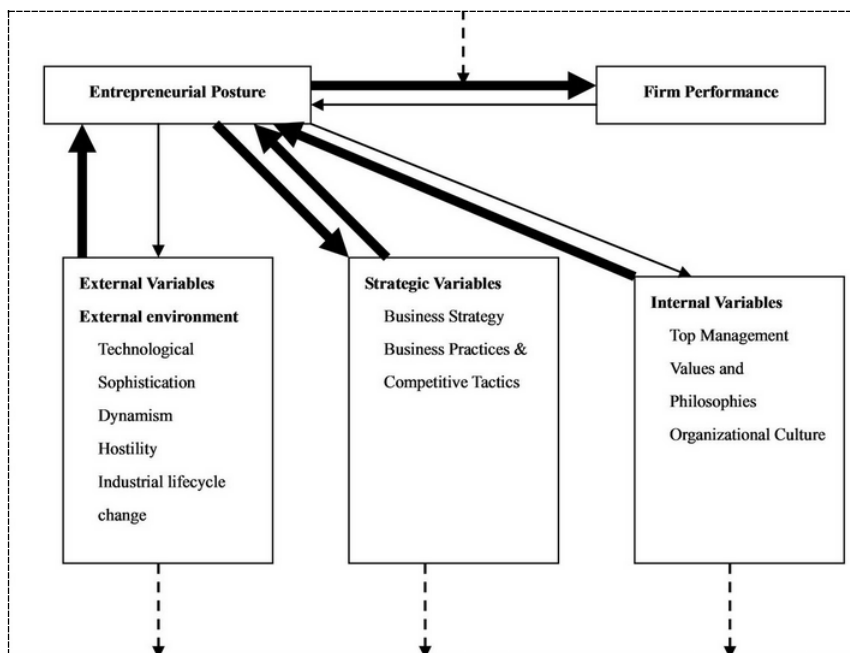
Figure 10 Conceptual model of Corporate Entrepreneurship by Covin and Slevin (1991)

This conceptual framework was important for the present research study as it identified a basis upon which the study variables could be constituted and how the link with entrepreneurial activity (or posture) which drew upon innovation was derived. It was inherent that creating the entrepreneurial culture, building the entrepreneurial organisation and managing the entrepreneurial organisation could therefore be interlinked.

Hornsby et al. (1993): Finally, the last model that encompass the base of corporate entrepreneurship was the model proposed by Hornsby et al. (1993) (see Figure 11) which showed the interaction of organisational factors with those of individual characteristics. Organisational factors in this case encompass management support, work discretion, rewards/reinforcement, time availability and organisational boundaries. Individual characteristics, on the other hand, include risk-taking propensity, desire for autonomy, need for achievement, goal orientation and internal locus of control.
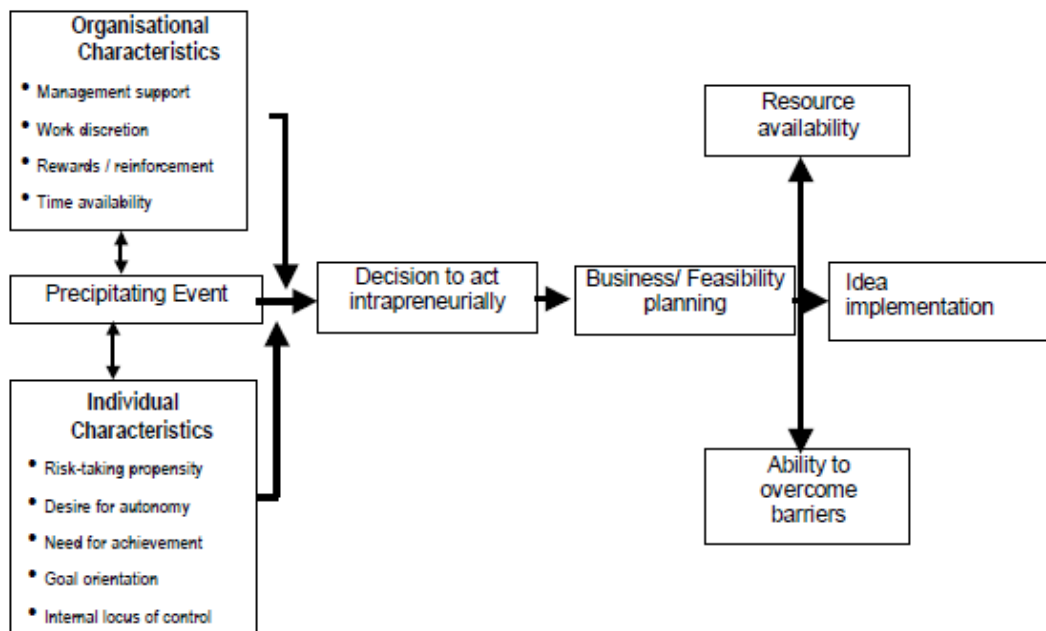
Figure 11 An interactive model of corporate entrepreneurship by Hornsby et al. (1993)

Once analysed the two Entrepreneurial University models and the four models that composed the frame of reference to analyse and describe the corporate entrepreneurship phenomenon, two main conclusions were drawn: the first one regarding the connections between the variables, since four out of the six models ((Guth and Ginsberg, 1990, Covin and Slevin, 1991, Guerrero et al., 2011, Peterka, 2011)) had direct relationships between the factors and the outcome, and the second one regarding the first order construct, since four out of the six models ((Burgelman, 1983, Guth and Ginsberg, 1990, Covin and Slevin, 1991, Guerrero et al., 2011)) classified their factors into three groups: external, strategic and organisational.

2.4   MEASURING THE ENTREPRENEURIAL UNIVERSITY

Another important aspect to consider is to establish how to measure the Entrepreneurial University. Thus, the objective of the present chapter is related to Entrepreneurial University metrics.

In fact, two different currents were detected for measuring the Entrepreneurial University.

i.   Authors such as Clark (1998), Sporn (2001), Etzkowitz (2004), Hindle (2010), Peterka (2011), European Commission (2012) and Mavi (2014) measured the Entrepreneurial University based on the level that it achieves developing the factors that described the Entrepreneurial University. In other words, they measured the factors that made up the Entrepreneurial University; indeed, the factors that were identified within the previous three sections.

ii.   Another group of authors, such as Wong et al. (2007), Guerrero and Urbano (2010), Sooreh et al. (2011), Gibb (2012) and Walshok and Shapiro (2014), described a set of indicators for measuring the Entrepreneurial University (see Table 18).

Table 18 Summary of indicators for measuring the Entrepreneurial University's results

Wong et al. (2007)	Guerrero and Urbano (2010)	Sooreh et al. (2011)	Gibb (2012)	Walshok and Shapiro (2014)
High tech venture created or facilitated by the university	Generation of job seekers	Third mission	Higher Innovation	University licensing (number of licenses, licensing revenue)
Talented graduates with entrepreneurial mindsets	Generation of entrepreneurs		Research Excellence	Equity positions
Top talents (researchers, students) attracted to work & study in university	Publishing scientific papers		Research Relevance	Coordination capacity (number of shared clients)
World-class R&D innovations attracted to collaborate with university	Publishing Papers with practical implications		Competitiveness	Information processing capacity (invention disclosures, sponsored research)
Venture capital funs & preferred community attracted by university	Knowledge transfer (patents, licenses, contracts)		Diverse Revenue Flow	Royalties
	Promotion of entrepreneurial culture		Student Employability	Patents (number of patents, efficiency in generating new patents)
	Contribution to regional development		Teaching Quality	
			Learning Organisation	

Three out of these five authors based the Entrepreneurial University's results on the three missions of the university: teaching, research and entrepreneurship

simultaneously. In fact, they identified different indicators for measuring the teaching outcome (it was oriented to generate graduates who should become not only job-seekers but also job-creators or entrepreneurs), the research outcome (it was based on developing research talent and academic entrepreneurs, knowledge generation and knowledge transfer) and the entrepreneurship outcome (including, entrepreneurial infrastructure, entrepreneurial culture, and alliances, cooperation and networks).

After analysing the previous studies and comparing with the results obtained through Section 2.1 (definitions of the Entrepreneurial University), a discrepancy was detected regarding the measurement method of the newest mission of the Entrepreneurial University. Certainly, the literature review showed that this third mission was related to the economic and social development (Chrisman et al., 1995, Dill, 1995, Röpke, 1998, Etzkowitz et al., 2000, Jacob et al., 2003, Guerrero et al., 2006, Yokoyama, 2006, Benneworth, 2007, Cargill, 2007, Mohar and Kamal, 2007, Guenther and Wagner, 2008, Mohar et al., 2010, Meyer, 2011, Philpott et al., 2011), which in turn was based on academic entrepreneurship activities (Etzkowitz et al., 2000, Klofsten and Jones-Evans, 2000, Kim, 2008, Philpott et al., 2011). Indeed, academic entrepreneurial activities were the mechanisms for promoting this economic and social development; possibly, turning into Entrepreneurial University's results. Due to this fact, the next sections deal with the review of academic entrepreneurship activities.

2.4.1 Academic entrepreneurship activities

The Bayh-Doyle Act of 1980 spurred growth in academic entrepreneurship activities in universities across the United States (Osiri et al., 2013). In response to such government pressure and industry solicitations, universities assumed the additional role of promoting economic development; in pursuit of this goal, intellectual property (onwards IP) from universities was exploited to create high technology companies (Etzkowitz, 2003c).

Previous research into academic entrepreneurship activities tended to equate such an activity with the creation and development of a new organisation, commonly known as spin-off firm (Autio, 1997, Klofsten and Jones-Evans, 2000, Powers and McDougall, 2005). However, the economic and social development was not simply about the outcome of launching spin-offs (Klofsten and Jones-Evans, 2000, Grimaldi et al., 2011); it was only one type of academic entrepreneurship activities. Therefore, Table 19 shows a review of academic entrepreneurship activities.

Continuing in the same vein, in recent years a rapid increase in technology based economic development initiatives occurred (Grimaldi et al., 2011), focused mainly on stimulating entrepreneurship in universities through academic entrepreneurship activities (Mohar et al., 2010). From this baseline, many authors developed their own classifications regarding academic entrepreneurship activities. For instance, Louis et al. (1989) identified five types of academic entrepreneurship activities: (i) large-scale science (obtaining externally funded research projects), (ii) earning supplemental income outside the university, mainly

through consulting, (iii) soliciting funds from industry, (iv) patenting research results and (v) forming companies based on research results; Brennan et al. (2005) and Brennan and McGowan (2006) established six areas of a "third" stream of university funding, concretely (i) consultancy, (ii) public-sector contracts, (iii) private-sector contracts, (iv) joint ventures, (v) spinout firms, (vi) spin-in firms and (vii) intellectual capital management; Kim (2008) divided academic entrepreneurship activities into two groups: (i) "indirect" (characterised by universities' close relationship with industry) and (ii) "direct" (characterised by the direct contribution to the economic and social development) commercialisation of knowledge; from this baseline, Philpott et al. (2011) suggested that academic entrepreneurship activities exist across a spectrum of "soft" and "hard" initiatives, depending on the potential of each activity to contribute to the economic and social development. Indeed, on the one hand, "hard" or "direct" activities were generally perceived to be more tangible outputs (Rasmussen et al., 2006), fostering the economic and social development directly; and on the other hand, "soft" of "indirect" activities were characterised by universities' close relationship with industry (Kim, 2008), boosting the economic and social development in an indirect way (through industry).

Table 19 Review of academic entrepreneurship activities

	Louis et al. (1989)	Klofsten and Jones-Evans (2000)	Ranga et al. (2003)	Lazzeroni and Piccaluga (2003)	Laukkanen (2003)	O'Shea et al. (2004)	Brennan et al. (2005)	Brennan and McGowan (2006)	Mohar and Kamal (2007)	Wong et al. (2007)	Siegel et al. (2007)	Kim (2008)	Wright et al. (2008)	Mohar et al. (2010)	Philpott et al. (2011)	Grimaldi et al. (2011)	Davey et al. (2011)	TOTAL
Creation of a technology Park			x				x								x			3
Creation of Incubators			x															1
Joint Ventures					x	x	x											3
Spin-off Firm Formation	x	x	x	x			x	x	x	x	x		x	x	x	x	x	14
Patenting and Licensing	x	x	x	x	x				x	x	x	x	x	x	x	x	x	14
Testing			x															1
Sales / Commercial exploitation			x		x													2
Large scale research projects	x	x			x													3
Contract Research		x				x							x	x	x	x	x	7
Funding of academic chairs				x														1
Collaborative research				x	x	x				x	x	x				x	x	8
Industry Training Courses		x			x			x					x		x	x	x	7
Consulting	x	x				x	x						x	x	x	x		8
Grantsmarnship				x											x			2
Information dissemination			x			x									x	x		4
Industry mobility			x										x	x		x	x	5
Networking			x	x		x										x		4
Producing Highly Qualified Graduates						x									x			2

From the previous review of academic entrepreneurship activities, the fact that spin-off firm formation was only one type within these activities was corroborated; since, other mechanisms such as licensing, patenting, collaborative research, contract research and consulting, as well as ad-hoc advice and networking with

practitioners (D'Este and Patel, 2007, Perkmann and Walsh, 2008, Wright et al., 2008, Grimaldi et al., 2011) were as important as spin-off firm formation. In addition to these activities, joint publication with industry and personnel-related learning activities such as staff exchange and joint student supervision (Schartinger et al., 2002) also appeared as less mentioned academic entrepreneurship activities. Table 20 shows a brief description of each academic entrepreneurship activity divided into two groups: Soft academic entrepreneurship activities (onwards Soft AEA) and Hard academic entrepreneurship activities (onwards Hard AEA).

Table 20 Description of each academic entrepreneurship activity

	Academic Entrepreneurship Activities	*Description*
Hard AEA	Creation of a technology park	Supplying a formal site where businesses (normally of a high-tech nature) can locate and interact with the university itself (Philpott et al., 2011).
	Creation of incubators	To set-up incubators to encourage the creation of USOs. These incubators provide access to a range of services from premises and equipment to financing, consultancy, training, accommodations, contact with partners, etc. (Mustar and Wright, 2010).
	Joint venture with private companies	"Research joint venture" is a notion that applies to a wide range of situations, from the arm-length research contract to long term relationships (Peerbaye and Mangematin, 2005).
	Spin-off firm formation	Academic spin-offs are new companies that evolve out from universities as a result of the process of technology transfer from research to commercialisation of new products or services (Iacobucci et al., 2011).
	Patenting and Licensing	The securing of intellectual property rights on discoveries and know-how developed within the university (Philpott et al., 2011).
Soft AEA	Testing	Provision of testing and calibration facilities to non university individuals and external organisations (Klofsten and Jones-Evans, 2000).
	Sales / Commercial exploitation	Commercial selling of products developed within the university (Klofsten and Jones-Evans, 2000).
	Large scale research projects	Obtaining large externally funded research projects, either through public grants or through industrial sources (Klofsten and Jones-Evans, 2000).
	Contract Research	Undertaking specific research projects with industry; many of these projects have a strong commercial focus (Philpott et al., 2011).
	Funding of academic chairs by private firms	Academic chairs directly paid for by private companies (Lazzeroni and Piccaluga, 2003).
	Collaborative research	A collaborative research agreement involves multiple partners, often a mixture of private and public sector actors, working together on a particular research project. Each partner contribute an amount of money, skilled talent, and technology to a central pot that they then harness to conduct research (Gold et al., 2007).
	Industry Training Courses	Teaching students from industry. These courses can include executive education (Philpott et al., 2011).
	Consulting	Directly selling academic expertise to external organisations to solve practical problems (Philpott et al., 2011).
	Grantsmarnship	Obtaining large-scale research grants from external sources for basic research (Philpott et al., 2011).
	Information dissemination	Publishing books, chapters and articles and developing doctoral dissertations in collaboration with industry (Philpott et al., 2011).
	Industry mobility	Mobility of students, academics and industrial collaborators between university and industry (Davey et al., 2011, Gibb, 2012).
	Networking	Interpersonal contacts, learning through experience or imitation, face to face exchanges, personnel mobility (Lazzeroni and Piccaluga, 2003).
	Producing Highly Qualified Graduates	Providing the workforce with skilled undergraduates and postgraduates (Philpott et al., 2011).

Based on various authors' classifications on academic entrepreneurship activities, eighteen different activities were identified. However, some of them have hardly any presence in the literature; thus a ranking of the most cited activities was done (see Table 21) in order to identify the ones with higher presence within the literature.

Table 21 Citation ranking of academic entrepreneurship activities

Academic Entrepreneurship Activities	Total	Type
Patenting and Licensing	14	Hard
Spin-off Firm Formation (students and academics)	14	Hard
Collaborative / Contract research	8	Soft
Consulting	8	Soft
Industry Training Courses	7	Soft
Industry Mobility	5	Soft
Information dissemination	4	Soft
Networking	4	Soft
Joint Venture with private companies	3	Hard
Large scale research projects	3	Soft
Creation of a technology Park	3	Hard
Sales / Commercial exploitation	2	Soft
Producing Highly Qualified Graduates	2	Soft
Creation of Incubators	1	Hard
Grantsmarnship	2	Soft
Testing	1	Soft
Funding of academic chairs by private firms	1	Soft

Once the general overview of academic entrepreneurship activities was done, in the next two sections a deeper analysis of Hard AEA and Soft AEA was developed; in order to identify and explain in more detail the academic entrepreneurship activities.

2.4.2   Hard academic entrepreneurship activities

As mentioned in the introduction of the present chapter, Hard AEA were directly related to the regional and economic development, as well as the financial wellbeing of the university (Philpott et al., 2011). In Table 21 were shown the three most cited Hard AEA, specifically: (i) academic spin-off firm formation, (ii) student spin-off firm formation and (iii) patents and licenses; and within the following lines a deep review of these three activities is done.

Spin-off firm formation

Due to the high interest within the academic world towards the spin-off firm formation (Di Gregorio and Shane, 2003, O'Shea et al., 2004, Grandi and Grimaldi, 2005, Lockett et al., 2005, Landry et al., 2006, Gómez Gras et al., 2008, Fini et al., 2009, Ebersberger and Pirhofer, 2011, Van Looy et al., 2011), in the following lines a review of its different definitions and classifications is shown.

It is commonly known that the spin-off firm formation is the most studied academic entrepreneurship activity, even though it is not the only one. During the last twenty years, many authors analysed the spin-off firm formation as the most

important mechanisms for academic entrepreneurship. Although it is such an important element within the technology transfer domain, many authors defined the spin-off concept in a wide variety of ways (see Table 22).

Table 22 Review of spin-off firm definitions (adapted from Pirnay et al. (2003))

Authors, Year	Definitions
McQueen and Wallmark (1982)	"…in order to be classified as a university spin-off, three criteria has to be met: (i) the company founder or founders have to come from a university (faculty, staff or student); (ii) the activity of the company has to be based on technical ideas generated in the university environment; and (iii) the transfer from the university to the company has to be direct and not via an intermediate employment somewhere".
Smilor et al. (1990)	"…a company that is founded (i) by a faculty member, staff member, or student who left the university to start a company or who started the company while still affiliated with the university; and/or (ii) around a technology or technology-based idea developed within the university".
Weatherston (1995)	"…a business venture which is initiated, or become commercially active, with the academic entrepreneur playing a key role in any or all of the planning, initial establishment, or subsequent management phases".
Carayannis et al. (1998)	"…a new company formed by individuals who were former employees of a parent organisation (the university), around a core technology that originated at a parent organisation and that was transferred to the new company".
Jones-Evans (1998)	"…the formation of a new firm or organisation to exploit the results of the university research".
Bellini et al. (1999)	"…companies founded by university teachers, researchers, or students and graduates in order to commercially exploit the results of the research in which they might have been involved at the university…the commercial exploitation of scientific and technological knowledge is realised by university scientists (teachers or researchers), students and graduates".
Rappert et al. (1999)	"…firms whose products or services develop out of technology-based ideas or scientific/technical know-how generated in a university setting by a member of faculty, staff or student who founded (or co-founded with others) the firm".
Clarysse et al. (2000)	"…new companies set up by a host institute (university, technical school, public/private R&D department) to transfer and commercialize inventions resulting from the R&D efforts of the departments".
Klofsten and Jones-Evans (2000)	"…formation of new firm or organisation to exploit the results of the university research".
Steffensen et al. (2000)	"…a new company that is formed (i) by individuals who were former employees of a parent organisation, and (ii) a core technology that is transferred from the parent organisation".
Pirnay et al. (2003)	"…new firms created to exploit commercially some knowledge, technology or research results developed within a university".
Pérez Pérez and Sánchez (2003)	"…an entrepreneurial spin-off arises when an entrepreneur leaves an organisation to start a firm of her/his own and it includes the transfer of some rights".
Djokovic and Souitaris (2008)	"…companies which evolve from universities through commercialisation of intellectual property and transfer of technology developed within academic institutions".
Iacobucci et al. (2011)	"…new companies that evolve out from universities as a result of the process of technology transfer from research to commercialisation of new products or services".

After analysing these definitions, it was concluded that almost all of them described the concept fulfilling the following three conditions (Pirnay et al., 2003):

- It takes place within an existing organisation, generally known as "parent organisation".
- It involves one or several individuals, whatever their status and function within the "parent organisation".
- These individuals leave the "parent organisation" to create a new enterprise.

The literature regarding spin-off firms covered a wide field of different topics (Kathrin, 2010). On the one hand, on the macro level, many studies investigated the spin-off phenomenon at the university level (Steffensen et al., 2000, Di Gregorio and Shane, 2003, Lockett et al., 2003, Clarysse and Moray, 2004, O'Shea et al., 2005, Powers and McDougall, 2005); and on the other hand, others focused on spin-off characteristics development and performance, the micro level (Steffensen et al., 2000, Pirnay et al., 2003, Druilhe and Garnsey, 2004, Hindle and Yencken, 2004, Walter et al., 2006).

Within the latter spin-off research stream (the one focused on spin-off characteristics), many authors provided different criteria for classifying and understanding the different facets of the concept (Ndonzuau et al., 2002). Building on spin-off literature, this type of academic entrepreneurship activity could be classified based on the following four characteristics: (i) their relationship with the parent organisation, (ii) relationship with the marketplace, (iii) their business model and (iv) individual status vs. nature knowledge of research.

Going deeper into this last classification of spin-off firms, the importance of the status of the individual involved in the business venturing process was noticed. Spin-off firms are usually initiated by individuals coming either from the "scientific" community including people with substantial research experience such as professors, assistants, researchers and doctoral students (Mustar, 1997, Clarysse et al., 2000), or from the "student" community with little in-depth research background (Bellini et al., 1999, Laukkanen, 2000). In fact, according to Pirnay et al. (2003) "academic spin-offs" (onwards ASO) are basically created to exploit, in business, some promising results obtained by university researchers, and "student spin-offs" (onwards SSO) are usually launched to exploit a business opportunity that is rarely grounded on extensive research activities. Due to this fact, it was decided to divide the variable spin-off firm formation into these two types: ASO and SSO.

Patenting and Licensing

As it was shown at the beginning of this section, the Bayh–Dole Act of 1980 is often considered as a landmark in university patenting (Etzkowitz et al., 2000). This law granted permission for federally funded researchers to file for patents, and to issue licenses for these patents to other parties. Due to the proclaimed effects of this law in the USA, other governments were encouraged to introduce similar legislation (Leydesdorff and Meyer, 2010), such as Belgium, Finland, Slovenia, Hungary and Australia (Meyer, 2008).

According to Mowery and Sampat (2001) and Powers and McDougall (2005) the traditional mechanisms by which the university developed and commercialised a technology was via patenting and licensing of an intellectual property to a large, established company who ultimately develops the technology into a saleable good. Furthermore, Bercovitz and Feldman (2006) described in detail the licensing university "which provides the right for companies and others to use intellectual property in the codified form of either patents or trademarks". According to them, "contractual licensing agreements involve selling a company the rights to use of a university's inventions in return for revenue in the form of up-front fees" and the regular payments of royalties. However, although universities exploit their inventions primarily through the licensing of technology, licensing was not equally effective across all technologies (Levin et al., 1987), the incentive to become more commercially focused led universities to concentrate their patenting in fields in which knowledge is transferred effectively through licensing. Furthermore, economists provided quantitative evidence of the beneficial effect on private sector activity of knowledge spillovers from university patenting (Shane, 2004a).

Finally highlighted that choosing between licensing and patenting a technology or creating a spin-off, depends on the nature of the technology to be transferred, the market for this technology and the institution's mission (Cervantes, 2003). Focusing on the technology's characteristics, Godinho and Mamede (2005) pointed out that the characteristics of the technology and of the knowledge affect the rate of spin-off. Following such perspective, one may infer that technologies most likely to be codified or patented were more likely to be licensed, while technologies with a more intense tacit dimension were more likely to be exploited by spin-offs.

2.4.3   Soft academic entrepreneurship activities

Soft academic entrepreneurship activities are indirectly related to the regional economic development, as well as the financial wellbeing of the university (Philpott et al., 2011). Even more, some authors such as Kim (2008) stated that Soft AEA are characterised by UBC. Due to the close relationship between Soft AEA and UBC, it seems necessary to analyse UBC mechanisms in order to identify more Soft AEA.

In fact, the importance of UBC increased in the industrialised world since the late 1970s. Studies in USA showed not only an increasing share of academic research funded by industry but a steady rise in university-industry and other forms of R&D partnering (Caloghirou et al., 2001). The link between academia and industry has traditionally been weaker in Europe than in the United States (Prosser, 1992); however, in more recent year European governments have taken actions to support research interaction between the two sectors through national research programs. Due to this fact, the increase of UBC has been reported by various studies around the world in recent years (Caloghirou et al., 2001).

Davey et al. (2011) defined the UBC as all types of direct and indirect, personal and non-personal interactions between higher education institutions and business for reciprocal and mutual benefit. Concretely, primary objectives of firms to

collaborate with universities include research synergies, keeping up with major technological developments, and R&D cost sharing (Caloghirou et al., 2001). In this vein, many authors such as Santoro (2000), Jacob et al. (2000) and Dooley and Kirk (2007) identified different UBC mechanisms. Table 23 shows a review of the most cited UBC mechanisms.

Table 23 Review of university business cooperation mechanisms

	Schmoch (1999)	Santoro (2000)	Cohen et al. (2002)	Schartinger et al. (2002)	Ranga et al. (2003)	Bercovitz and Feldman (2006)	Phan and Siegel (2006)	Eun et al. (2006)	Declaration (2007)	Johannesson (2008)	Arvanitis et al. (2008)	Manjarrés-Henríquez et al. (2008)	Davey et al. (2011)	Mathieu (2011)	TOTAL
Gifts and endowments by industrial partners (e.g. professorial chairs, etc.)		x							x						2
Collaborative research	x		x		x	x	x	x	x	x			x	x	10
Joint or Cooperative ventures			x												1
Technology Parks					x	x									2
Creating Incubators				x	x										2
Research consortiums					x						x				2
Informal contacts / Networking	x	x	x	x							x			x	6
Joint Conferences, workshops…				x				x			x			x	4
Use of university facilities by firms				x				x						x	3
Joint laboratories											x				1
Governance													x		1
Provision of graduates to industry	x	x	x	x											4
Students participation in corporate R&D projects											x				1
Institutional programs		x			x										2
Curriculum development													x		1
Cooperative education		x													1
Consultancy	x		x	x					x		x				5
Seminars for industrial researchers	x														1
Joint Publications	x		x	x							x			x	5
Joint teaching courses or programmes											x			x	2
Personal mobility	x		x	x					x				x	x	6
Joint Doctoral theses	x			x							x				3
Training firm members				x					x	x	x	x	x		6
Lectures at university, held by firm members				x				x							2
Technology sales								x							1
Commercialization support										x		x			2
Contract research	x		x	x					x	x	x	x		x	8
Product development and commercialisation activities		x													1

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2.5   SUMMARY

The objective of the present chapter was to review the literature on Entrepreneurial Universities, emphasising the identification of the factors that made it up, the indicators for measuring it and the relationships between the previous two. Thus, in order to achieve this triple goal, the strategy of analysing different Entrepreneurial University concepts was followed; such as analysing its definition, characteristics, theoretical frameworks and empirical studies. This strategy was pursued due to the ambiguity of the topic (Bronstein and Reihlen, 2014), since it is a lack of consensus on what an Entrepreneurial University is (Guerrero and Urbano, 2012).

Thereby, first of all, based on the characteristics previously identified from the definitions and characteristics review, a characterisation of the Entrepreneurial University was done; defying it as an academic institution that had the following characteristics:

- It develops the entrepreneurial culture on all levels (Clark, 1998, Röpke, 1998, Sporn, 2001, Kirby, 2002, Etzkowitz, 2003c, Clark, 2004, Gibb et al., 2009, Bratianu and Stanciu, 2010, Meyer, 2011).
- Its mission, goals, structure, governance and management are defined to be adaptive to environment fluctuations (Clark, 1998, Sporn, 2001, Bratianu and Stanciu, 2010, Meyer, 2011).
- It has a strong interaction with its environment, developing external relationships (Röpke, 1998, Sporn, 2001, Blenker et al., 2006, Gibb et al., 2009, Bratianu and Stanciu, 2010).
- It has a diversified funding base (Clark, 1998, Clark, 2004).
- It contributes to the economic and social development (Chrisman et al., 1995, Dill, 1995, Röpke, 1998, Etzkowitz et al., 2000, Jacob et al., 2003, Guerrero et al., 2006, Yokoyama, 2006, Benneworth, 2007, Cargill, 2007, Mohar and Kamal, 2007, Guenther and Wagner, 2008, Mohar et al., 2010, Meyer, 2011, Philpott et al., 2011).

The next step was to identify which were the factors that made up the Entrepreneurial University. Although many authors (e.g. Clark (1998), Sporn (2001), Etzkowitz (2004), Kirby (2006), Guerrero et al. (2006), Wong et al. (2007), Teh and Yong (2008), Peterka (2008), Hindle (2010), Salamzadeh et al. (2011), Gibb (2012), European Commission (2012) and Mavi (2014)) tried to define an Entrepreneurial University framework through different factors, most of them based their frameworks on completely different factors. Thereby, the review showed that (i) mission and strategy, (ii) entrepreneurship education, (iii) teaching methodologies, (iv) governance structure, (v) external environment, (vi) rewards, (vii) levering finance and (viii) university business cooperation were the most cited factors obtained from Entrepreneurial University's frameworks. In this context, it was important to note that the unique factor which was included within all frameworks was "Mission & Strategy".

Another important source for identifying Entrepreneurial University's factors was the analysis of empirical studies. Indeed, although there were few empirical

studies on Entrepreneurial Universities, many authors (e.g. Di Gregorio and Shane (2003), O'Shea et al. (2004), Grandi and Grimaldi (2005), Lockett et al. (2005), Landry et al. (2006), Gómez Gras et al. (2008), Fini et al. (2009), Ebersberger and Pirhofer (2011) and Van Looy et al. (2011)) focused their studies on identifying why some universities were more likely to spin-off firms formation than other; thereby, studies regarding spin-off firm formation were a new source for this Entrepreneurial University research.

Following the previous premise a literature review of empirical studies was done, which showed that the factors measured within this research stream were predominantly operational factors, such as: the existence of a TTO, policies and laws and access to the incubator, among others; although, there was also the presence of some strategic level factors, such as technology transfer strategies.

Afterwards, the different possibilities for measuring an Entrepreneurial University were analysed. In fact, two different currents were detected for measuring the Entrepreneurial University. On the one hand, authors such as Clark (1998), Sporn (2001), Etzkowitz (2004), Hindle (2010), Peterka (2011), European Commission (2012) and Mavi (2014) measured the Entrepreneurial University based on the level that it achieve developing the factors that described the Entrepreneurial University. On the other hand, there was another group of authors, such as Wong et al. (2007), Guerrero and Urbano (2010), Sooreh et al. (2011) and Gibb (2012), who described a set of indicators for measuring the Entrepreneurial University; without emphasising too much on the third mission of the university: the economic and social development. Therefore, and according to authors such as Kim (2008) and Philpott et al. (2011), who established that academic entrepreneurship activities are the mechanism for the economic and social development, a review of these activities was done.

There were many forms of academic entrepreneurship activities (Louis et al., 1989, Brennan et al., 2005, Brennan and McGowan, 2006, Kim, 2008, Wright et al., 2008, Philpott et al., 2011); however, all of them could be classified into two groups depending on their impact on the economic and social development: (i) Hard academic entrepreneurship activities and (ii) Soft academic entrepreneurship activities.

In fact, through the Hard academic entrepreneurship activities, a huge amount of studies related to spin-off firm formation was analysed; identifying four different classifications of spin-off firms: (i) the relationship with the parent organisation, (ii) the relationship with the marketplace, (iii) the individual status vs. nature knowledge of research and (iv) the business model. Thanks to this classification and getting more in deep into the individual status classification, a division between spin-off firms was identified: academic spin-offs and students spin-offs. Furthermore, in order to identify the most relevant Soft academic entrepreneurship activities, a review on UBC mechanism was done; identifying the next seven UBC mechanisms as the most cited ones: (i) collaborative research, (ii) contract research, (iii) lifelong learning education, (iv) personal mobility, (v) networking, (vi) consultancy and (vii) joint publications.

Chapter 3
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Research framework

3. RESEARCH FRAMEWORK

After developing the literature review regarding the Entrepreneurial University, analysing its different definitions, characteristics, frameworks and empirical studies, it led to detect the existence of various research challenges. Therefore, the present chapter deals with the critical analysis of the literature review, identifying these research gaps. And afterwards, the research framework is developed in order to work out these research challenges.

3.1 RESEARCH CHALLENGES

There is no consensus within the literature on Entrepreneurial Universities. There are several definitions and characteristics that built an Entrepreneurial University; however, each of them adds new concepts or adjectives, instead of unifying them. Analysing Entrepreneurial University's models, the same problem appeared. Only a few studies, such as Guerrero and Urbano (2010) and Peterka (2011), analysed the Entrepreneurial University empirically and most of them built their frameworks and models based on different factors. Due to this fact, a need for identifying the Entrepreneurial University determinant factors was noticed.

In this line, in the recent years, some research studies (e.g. Volkmann et al. (2009) and Gibb (2012)) highlighted the importance of new Entrepreneurial University determinant factors. These new factors (i.e., internationalisation, staff development in entrepreneurship and university support through the whole entrepreneurship process) have not been tested yet; thus, it was noticed the necessity to include these factors as Entrepreneurial University determinant factors and analyse the influence of them on Entrepreneurial University's results.

In addition, due to the low number of empirical research on Entrepreneurial Universities (Guerrero and Urbano, 2010), a referent model on Entrepreneurial University was missed. Therefore, in order to solve this gap, it was necessary to resort other entrepreneurship research streams which were more developed, such as the corporate entrepreneurship. Besides, according to Brennan and McGowan (2006), there was a lack of attention given to the organisational context within the Entrepreneurial University and a corporate view of entrepreneurship within the university was necessary.

Another research challenge identified was the measurement scale of the Entrepreneurial University; indeed, to define the Entrepreneurial University's results. Few authors (e.g. as Wong et al. (2007), Guerrero and Urbano (2010), Sooreh et al. (2011), Gibb (2012) and Walshok and Shapiro (2014)) measured the

output of an Entrepreneurial University, establishing indicators for each university's mission. In fact, for measuring Entrepreneurial Universities' third mission (the economic and social development) they stablished the following three general indicators: (i) generate and transfer knowledge to society, (ii) promote the entrepreneurial culture in all the university members and (iii) contribute to economic and regional development. They did not measure the different academic entrepreneurship activities that enable the economic and social development. Therefore, academic entrepreneurship activities were identified as the most appropriate indicators for measuring the Entrepreneurial University's results.

Finally, it was worth highlighting that the research methodologies employed in Entrepreneurial University literature were mainly three, the case study, the theoretical papers (e.g. reviews) and the surveys (Markuerkiaga et al., 2014). Indeed, the majority of reviewed empirical studies based their research on the "individual-level", where the unit of analysis is an academic scientist, and gets big sample sizes from very few universities. However, to understand the potential influence of different institutional elements upon the Entrepreneurial University the "institution level" (where the unit of analysis is the university as a whole or part of it) is the most appropriate approach.

From this basis, the following two research challenges were identified:

i.   To achieve an empirically tested Entrepreneurial University model; which shows the relationships between the Entrepreneurial University's factors and the Entrepreneurial University's results.

ii.   To provide an empirical-institutional approach to research on the Entrepreneurial University.

Thus, through the next section the research framework is developed, which seeks to face up the previous research challenges and establish the baseline for the present research.

3.2   RESEARCH MODEL

As shown in the previous chapter (Chapter 2, Section 2.3), there was not nor a generally accepted Entrepreneurial University model, neither a generally accepted corporate entrepreneurship model; however, two main conclusions were drawn from the review: the first one regarding the connections between the variables, since four out of the six models ((Guth and Ginsberg, 1990, Covin and Slevin, 1991, Guerrero et al., 2011, Peterka, 2011)) had direct relationships between the factors and the outcome, and the second one regarding the first order construct, since four out of the six models ((Burgelman, 1983, Guth and Ginsberg, 1990, Covin and Slevin, 1991, Guerrero et al., 2011)) classified their factors into three groups: external, strategic and organisational. Therefore, it was decided to base the research model on Covin and Slevin (1991)'s conceptual model of entrepreneurship as firm behaviour, since it was established as the base model of almost all the current research on corporate entrepreneurship (Bieto, 2008).

Indeed, authors such as Zahra (1993), Narayanan et al. (2009) and Mokaya (2012) based their models on it.

Furthermore, according to Rothaermel et al. (2007) and Mavi (2014) few empirical studies have highlighted the importance of environmental and internal factors that conditioned the development of Entrepreneurial Universities with the teaching, research, and entrepreneurial missions; thus, the research framework of the present study was developed adapting Covin and Slevin (1991)'s corporate entrepreneurship model to Entrepreneurial Universities' shape, as defined by Rothaermel et al. (2007) and Grimaldi et al. (2011).

These latter authors described the Entrepreneurial Universities' taxonomy identifying the different research elements to take into account in Entrepreneurial Universities' research. On the one hand, Rothaermel et al. (2007) highlighted the internal elements of an Entrepreneurial University (e.g. status, location, policies, etc.) and the influence of external factors (including governmental laws and policies, and the surrounding industry). On the other hand, Grimaldi et al. (2011) considered three different levels inside the Entrepreneurial University, the system-level specificities (e.g. governmental actions, institutional configurations, local-context characteristics, etc.), the university-level entrepreneurship support mechanisms (entrepreneurship education, supportive infrastructures, funds for entrepreneurship, etc.) and the individual scientist level factors.

Thereby, adapting Covin and Slevin (1991)'s model, the developed Entrepreneurial University model maintained the external environmental factors and internal organisational factors, added the entrepreneurial support mechanisms and transformed the firm performance into Entrepreneurial University's results (see Figure 12).
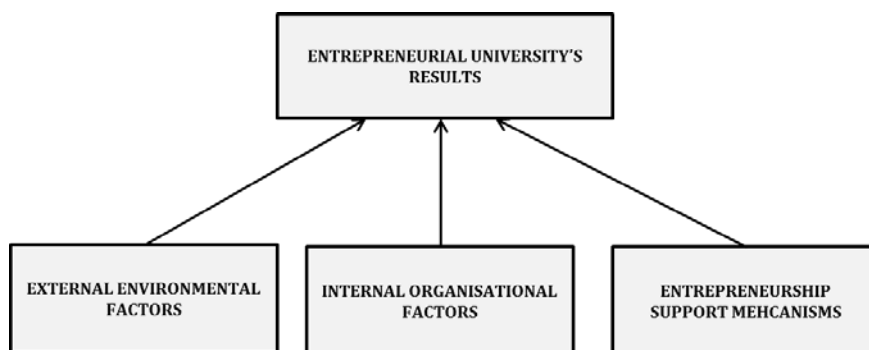
Figure 12 The developed Entrepreneurial University's model adapted from Covin and Slevin (1991)

Furthermore, Covin and Slevin (1991) developed the model as an organisational-level phenomenon; analysing the corporate entrepreneurship from an organisational-level. This was another important fact in order to base the research model on Covin and Slevin (1991)'s model; since this model solved the last research challenge identified, to analyse the Entrepreneurial University from an institutional perspective. Thereby, the university (as an organisation) was the unit of analysis and the Technology Transfer Office Directors the person to interact with. In addition, the present research was a quantitative research, using the

survey as the research strategy and an emailed questionnaire as the data collection method (in Section 4.3 there is more information regarding the research methodology).

3.2.1 Entrepreneurial University's factors

As it was shown through the previous chapter, diverse and varied factors which made up the Entrepreneurial University were identified. In Table 24 a summary of the most cited factors is shown, taking into account the four different points of views acquired: (i) definitions, (ii) characteristics, (iii) frameworks and (iv) empirical studies. This review showed that three factors had a higher presence within the literature on Entrepreneurial Universities; specifically, the external environment of the university, the mission and strategy pursued by the university and the university's organisational design. Besides, in a second place, management support, policies and regulation, and entrepreneurship education were identified as influential factors.

Table 24 Summary of the most cited Entrepreneurial University's factors

Factors	Entrepreneurial University definitions	Entrepreneurial University characteristics	Entrepreneurial University theoretical frameworks	Empirical Studies on spin-off firm formation
External Environment	x	x	x	
Mission & Strategy	x	x	x	x
Management support	x	x		
Organisational Design	x	x	x	
Policies & Regulations			x	x
Funds for entrepreneurship				x
Entrepreneurial Education			x	x
Teaching Methodologies				x
Incubator and/or technology park engagement				x

Although these were the most cited factors, in the recent years new insights on the Entrepreneurial University literature were gathering force (Volkmann et al., 2009, Gibb, 2012). Thus, due to both their novelty and the interest shown by some authors, the next four factors were selected to be included in the previous list.

   i. University support through the whole entrepreneurship process (Plaschka and Welsch, 1990, Friedman and Silberman, 2003, Prodan and Drnovsek, 2010, Wood, 2011).

   ii. Internationalisation (Salamzadeh et al., 2011, Allinson et al., 2012, Gibb, 2012).

  iii. Staff development in entrepreneurship (Hindle, 2001, Kuratko, 2005, Hindle, 2007a, Wilson, 2008, Volkmann et al., 2009, Aldridge and Audretsch, 2011, Salamzadeh et al., 2011, Gibb, 2012).

  iv. Industry presence in curriculum development and delivery (Davey et al., 2011).

Therefore, Table 25 encompasses all the factors, including the external environmental factors, the internal organisational factors and the entrepreneurship support mechanisms, that made up the Entrepreneurial University.

Table 25 References of Entrepreneurial University's factors

Concept	References
Institutional Context	Etzkowitz (2004), Rothaermel et al. (2007), Guenther and Wagner (2008), Fini et al. (2009), Hu (2009), Grimaldi et al. (2011), Fini et al. (2011), Heinzl et al. (2012) and Rasmussen et al. (2012)
Industry Context	Rothaermel et al. (2007), Fini et al. (2009) and Gibb (2012)
Mission & Strategy	Clark (1998), Etzkowitz (2004), Kirby (2006), Rothaermel et al. (2007), Gómez Gras et al. (2008), Bratianu and Stanciu (2010), Kirby et al. (2011), Grimaldi et al. (2011), Guerrero et al. (2011), Peterka (2011) and Salamzadeh et al. (2011)
Management Team Support	Clark (1998), Yokoyama (2006), Rothaermel et al. (2007), Kirby et al. (2011) and Guerrero et al. (2011)
Organisational Design	Gibb and Hannon (2005), Bratianu and Stanciu (2010) and Gibb (2012)
Policies & Laws	Di Gregorio and Shane (2003), O'Shea et al. (2005), Landry et al. (2006), Fini et al. (2009), Guerrero and Urbano (2012), Rothaermel et al. (2007), European Commission (2008) and Kirby et al. (2011)
Internationalisation	Gibb (2012) and Allinson et al. (2012)
University support through the whole entrepreneurship process	Plaschka and Welsch (1990), Friedman and Silberman (2003), Prodan and Drnovsek (2010), Wood (2011) and Salamzadeh et al. (2011)
Industry presence in curriculum D&D	Davey et al. (2011) and De Luca et al. (2014)
Funds for entrepreneurship	Di Gregorio and Shane (2003), Gómez Gras et al. (2008), Fini et al. (2009), Guerrero and Urbano (2012), Grimaldi et al. (2011) and Salamzadeh et al. (2011)
Entrepreneurship Education	Kuratko (2005), Gibb (2006), Hindle (2007a), van der Heide and van der Sijde (2008), Guerrero and Urbano (2012), Bratianu and Stanciu (2010), Lanero et al. (2011), Kirby et al. (2011), Grimaldi et al. (2011) and Bourgeois (2011)
Staff Development in Entrepreneurship	Hindle (2001), Kuratko (2005), Hindle (2007a), Volkmann et al. (2009), Wilson (2008), Aldridge and Audretsch (2011), Salamzadeh et al. (2011) and Gibb (2012)
Active teaching methods	Wilson (2008), Volkmann et al. (2009), Moroz et al. (2010), Guerrero and Urbano (2012), Kirby et al. (2011), Salamzadeh et al. (2011) and Heinzl et al. (2012)
Incubator engagement	Chrisman et al. (1995), Mian (1996), Feldman and Desrochers (2003), Etzkowitz (2003c), Jacob et al. (2003), Di Gregorio and Shane (2003), O'Shea et al. (2005), Yokoyama (2006), Rothaermel et al. (2007), Fini et al. (2009), Lehrer et al. (2009), Kirby et al. (2011) and Grimaldi et al. (2011)
Tech. Park engagement	Monck and McLintock (1988), Storey and Tether (1998), Siegel and Phan (2005), Phan and Siegel (2006) and Hagen (2008)

3.2.2 Entrepreneurial University's results

As shown in the previous chapter, the analysis and development of measurement criteria for the Entrepreneurial University was another research challenge. Indeed, through the literature review two different currents were detected for measuring the Entrepreneurial University: the first one measures through the development

level of its factors and the second one described a set of indicators for measuring the Entrepreneurial University.

After analysing the previous studies and comparing with the results obtained through Section 2.1, the measurement of the Entrepreneurial University through its capacity for promoting the economic and social development was seen essential; thus for the present research the second current was followed. In other words, the academic entrepreneurship activities were established as the Entrepreneurial University's results. Besides, various authors, such as Kim (2008) and Philpott et al. (2011), corroborated this decision since they stated that academic entrepreneurial activities were the mechanisms for this economic and social development. Therefore, a review or academic entrepreneurship activities was done in Section 2.4.

Dealing with these academic entrepreneurship activities, many different forms were identified within the literature; in fact, many author, such as Louis et al. (1989), Brennan et al. (2005), Brennan and McGowan (2006), Wright et al. (2008), Kim (2008) and Philpott et al. (2011), described academic entrepreneurship activities. Furthermore, although there was not a unified classification of them, it was seen that all forms of academic entrepreneurship activities could be classified into two groups depending on their impact on the economic and social development: (i) "hard" or "direct" activities and (ii) "soft" of "indirect" activities (Kim, 2008, Philpott et al., 2011). Following this approach, hard and soft academic entrepreneurship activities were analysed separately (see Section 2.4.2 and Section 2.4.3).

From hard academic entrepreneurship activities' review, the following three academic entrepreneurship activities were established as the most cited indicators: (i) patents and licenses, (ii) academic spin-offs and (iii) students spin-offs.

Afterwards, from the soft academic entrepreneurship activities' review the following ranking was obtained (see Table 26) and all of them were also established as Entrepreneurial University's results.

Table 26 Ranking of Soft academic entrepreneurship activities

Soft AEA	Total citations
Collaborative research	10
Contract research	8
Training firm members / Lifelong learning education	6
Personal mobility	6
Informal contacts / Networking	6
Consultancy	5
Joint Publications (Info dissemination)	5

Therefore, Table 27 shows the academic entrepreneurship activities which were used for measuring the Entrepreneurial University within the present research; in fact, the Entrepreneurial University's results.

Table 27 References of Entrepreneurial University's results

	References
Academic spin-off firm formation **Student spin-off firm formation**	Louis et al. (1989), Klofsten and Jones-Evans (2000), Ranga et al. (2003), Lazzeroni and Piccaluga (2003), Brennan et al. (2005), Brennan and McGowan (2006), Mohar and Kamal (2007), Wong et al. (2007), Siegel et al. (2007), Wright et al. (2008), Mohar et al. (2010), Philpott et al. (2011), Grimaldi et al. (2011) and Davey et al. (2011)
Patenting and Licensing	Louis et al. (1989), Klofsten and Jones-Evans (2000), Ranga et al. (2003), Lazzeroni and Piccaluga (2003), Brennan and McGowan (2006), Mohar and Kamal (2007), Wong et al. (2007), Siegel et al. (2007), Kim (2008), Wright et al. (2008), Mohar et al. (2010), Philpott et al. (2011) and Grimaldi et al. (2011)
Collaborative / Contract research	Lazzeroni and Piccaluga (2003), Laukkanen (2003), O'Shea et al. (2004), Mohar and Kamal (2007), Siegel et al. (2007), Kim (2008), Grimaldi et al. (2011) and Davey et al. (2011)
Consulting	Louis et al. (1989), Klofsten and Jones-Evans (2000), Brennan et al. (2005), Brennan and McGowan (2006), Kim (2008), Wright et al. (2008), Philpott et al. (2011) and Grimaldi et al. (2011)
Industry Training Courses	Klofsten and Jones-Evans (2000), Laukkanen (2003), Philpott et al. (2011), Grimaldi et al. (2011) and Davey et al. (2011)
Industry Mobility	Lazzeroni and Piccaluga (2003), Kim (2008), Wright et al. (2008), Grimaldi et al. (2011) and Davey et al. (2011)
Information dissemination	Lazzeroni and Piccaluga (2003), O'Shea et al. (2004), Philpott et al. (2011) and Grimaldi et al. (2011)
Networking	Ranga et al. (2003), Lazzeroni and Piccaluga (2003), O'Shea et al. (2004) and Grimaldi et al. (2011)

3.3   SUMMARY

Through this chapter an Entrepreneurial University model was developed, based on the Entrepreneurial University's factors and results identified within the literature review.

Indeed, fifteen factors were identified as Entrepreneurial University determinant factors and nine academic entrepreneurship activities as Entrepreneurial University's results (see Table 28). Furthermore, the model was worked out following the most cited corporate entrepreneurship model developed by Covin and Slevin (1991); thus, it was integrated by external environmental factors, internal organisational factors, entrepreneurship support mechanisms and Entrepreneurial University's results.

Table 28 Factors classification based on Covin and Slevin (1991)

		FACTORS
ENVIRONMENTAL EXTERNAL FACTORS		Institutional Context
		Industrial Context
ORGANISATIONAL INTERNAL FACTORS		Mission & Strategy
		Organisational Design
		Management support
ENTREPRENEURSHIP SUPPORT MECHANISMS		Policies
		Internationalisation
		University support through the whole entrepreneurship process
		Industry presence in curriculum D&D
		Funds for Entrepreneurship
		Entrepreneurship Education
		Staff development in entrepreneurship
		Active teaching methodologies
		Incubator
		Technology Park
ENTREPRENUERIAL UNIVERSITY'S RESULTS	**SOFT ACADEMIC ENTREPRENEURSHIPACTIVITIES**	Information dissemination
		Networking
		Mobility with industry
		Consulting
		Industry Training Courses
		Contract Research
	HARD ACADEMIC ENTREPRENEURIAL ACTIVITIES	Patenting & Licensing
		Student Spin-off Firm Formation
		Academic Spin-off Firm Formation

Chapter 4
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Research design and methodology

4. RESEARCH DESIGN AND METHODOLOGY

Once the research framework developed, identifying the Entrepreneurial University determinant factors and the Entrepreneurial University's results, the next step was to develop the appropriate research design and methodology. Therefore, the present chapter deals with the research objectives and the different research hypotheses.

In fact, this chapter concern with the research strategy that specified how the research was executed to address the research question posed. The research strategy is described by several authors (e.g. Cooper and Schindler (2008) and Saunders et al. (2011)) as comprising a general plan of how a researcher goes about answering a set of research question and the methods employed to achieve such a process.

This section of the study provides a plan that specifies how the research was structured to answer the research question. Specifically, (i) the research objectives are defined, (ii) the research process is designed, (iii) the data collection procedures are designed and (iv) the data analysis is designed.

The first part of this chapter describes the objective which the study aimed to achieve. After that, hypotheses statements are developed as a means to direct the investigation of the variables under study and articulate how these measures were carried out. In the second part, the architecture of the research design stipulated the research methodology as the general implementation and execution plan. This encompasses the data collection design, the sampling design and the instrument design. The third part concentrates on data collection procedures, where the data collection instrument is described. Then, the data analysis procedures are indicated. And finally, the study variables are shown.

4.1   RESEARCH OBJECTIVES

The main objective that was pursued with the development of this thesis was to:

Develop an empirical-institutional analysis of the factors that affects the Entrepreneurial University.

For the achievement of this central goal three specific objectives were established, which in turn made up the different phases to be developed through the research. Thereby, in the present section these specific objectives were described more in detail.

As shown through Chapter 3, the external environmental factors, internal organisational factors and entrepreneurship support mechanisms made up the Entrepreneurial University, in addition to Entrepreneurial University's results; thus, specific objectives were related to these factors.

In fact, the external environment was identified as a component of the proposed model because of its role in entrepreneurship theory and research (Covin and Slevin, 1991). The concept of external environment was intended to include those forces and elements external to universities' boundaries that affect the institution. However, there were few studies that looked at how the environment influences entrepreneurship within a university (Rasmussen et al., 2012).

Moving on to analyse internal organisational factors, empirical studies suggest that they play a major role in encouraging corporate entrepreneurship (Zahra and Covin, 1995) which could be extrapolated to academic entrepreneurship; since authors, such as Munene (2008), stated that internal factors provided the impetus for university transformation towards the Entrepreneurial University.

As was discussed so far, the Entrepreneurial University is a term now being used to refer to universities which possess a wide range of new support mechanisms for fostering entrepreneurship within the organisation (Jacob et al., 2003). In this sense, Coduras et al. (2008) assumed that the use of entrepreneurship support mechanisms could have positive effects on Entrepreneurial University's results. Indeed, several researchers (e.g. Jacob et al. (2003) and Lazzeretti and Tavoletti (2005)) identified a number of European and Oceanic universities that promoted these entrepreneurial support mechanisms; however, little was known about how these support mechanisms contribute to the emergence of the Entrepreneurial University (Guerrero et al., 2011).

Thus,

> **Specific Objective 1:** To analyse the relationships between external environmental factors, internal organisational factors, entrepreneurship support mechanisms and Entrepreneurial University's results.

Furthermore, in order to achieve this first objective the following three sub-objectives were carried out:

✓ *To analyse the relationship between external environmental factors and Entrepreneurial University's results.*

✓ *To analyse the relationship between internal organisational factors and Entrepreneurial University's results.*

✓ *To analyse the relationship between entrepreneurship support mechanisms and Entrepreneurial University's results.*

Regarding the entrepreneurship support mechanisms, Mohar et al. (2009) stated that a higher promotion of them within a university leads to better Entrepreneurial University's results. Due to this fact, it was necessary to analyse

the impact of entrepreneurship support mechanisms on Entrepreneurial University's results.

Furthermore, the different types of Entrepreneurial University's results (Hard AEA and Soft AEA) had to be emphasized, since prior research on UBC indicates that universities with closer ties to industry generate a greater number of spin-offs firms (Roberts and Malone, 1996, Gulbrandsen and Smeby, 2005, Prodan and Drnovsek, 2010). This insinuated that there could be a relationship between Hard AEA and Soft AEA. In contrast, Prodan and Drnovsek (2010) showed empirically that UBC was not directly and significantly related to Hard AEA. Based on this discussion it was necessary to analyse if there was any relationship between the universities which obtain more Hard AEA and the ones that obtain more Soft AEA.

Thus,

> **Specific Objective 2:** To analyse the impact of each entrepreneurship support mechanism on Entrepreneurial University's results.

Furthermore, in order to achieve this second objective the following four sub-objectives were carried out:

- ✓ *To describe the impact of entrepreneurship support mechanisms on Entrepreneurial University's results.*

- ✓ *To analyse the impact of entrepreneurship support mechanisms on Hard Entrepreneurial University's results.*

- ✓ *To analyse the impact of entrepreneurship support mechanisms on Soft Entrepreneurial University's results.*

- ✓ *To estimate a predictive model and identify the most critical factors which must be influenced in order to evolve a university from its current scenario in Entrepreneurial University's results to a superior one.*

And,

> **Specific Objective 3:** To develop a universities' taxonomy depending on Entrepreneurial University's results.

4.2   RESEARCH HYPOTHESES

Once the leading research objectives were established and the research framework developed, this section presents a subset of ten specific research hypotheses that were generated on the basis of the literature review findings and synthesis. These hypotheses were the guidelines for the research, indicating what it was going to be tested; in fact, they provided a very useful bridge between the research objectives and the design of the enquiry (Robson, 1993). The following lines show these hypotheses.

Specific Objective 1: To analyse the relationships between external environmental factors, internal organisational factors, entrepreneurship support mechanisms and Entrepreneurial University's results.

Sub-objective 1.1.: To analyse the relationship between external environmental factors and Entrepreneurial University's results.

The external environment was a relevant factor that was recognised within the literature (Covin and Slevin, 1991), although there were few studies that looked at how specific environments may influence entrepreneurship within a university (Rasmussen et al., 2012). Indeed, the concept of external environment was intended to include those forces and elements external to universities' boundaries that affect the institution.

As Etzkowitz (2004) stated, nowadays universities are interacting more and more with industry and governmental institutions in order to become Entrepreneurial Universities; increasing the importance of the external environment. In fact, universities are embedded in a larger environmental context, since policy decisions, continuously influences the way the universities participate in entrepreneurial activities (Rothaermel et al., 2007). Besides, a supportive external environment develops entrepreneurial support services directly targeted at helping new ventures in their early stages of life (Fini et al., 2011).

This approach gave rise to the first hypothesis:

Hypothesis 1: External environmental factors influence positively and significantly on Entrepreneurial University's results.

Sub-objective 1.2.: To analyse the relationship between internal organisational factors and Entrepreneurial University's results.

Authors such as Brennan and McGowan (2006), Bercovitz and Feldman (2008), Munene (2008), Clarysse et al. (2011) and Yusof et al. (2012) reiterated on the influence of internal organisational factors on the impetus for university transformation towards the Entrepreneurial University. Indeed, Guerrero and Urbano (2012) proposed an integrated model to understand both environmental and internal conditioning factors that explain the Entrepreneurial Universities.

Bronstein and Reihlen (2014) described the Entrepreneurial University as a university able to adapt to market characteristics and external surroundings through internal organisational changes and structural flexibility, thus it portrays project-driven and ad-hoc structures as well as flexible and autonomous governance practices. Furthermore, the correct identification of internal organisational factors, which might represent strengths or weaknesses, becomes crucial, as an Entrepreneurial University needs to design and implement better strategies combining current and new resources (Barnett, 2000, Antoncic and Hisrich, 2001, Gajon, 2011).

This approach gave rise to the second hypothesis:

Hypothesis 2: Internal organisational factors influence positively and significantly on Entrepreneurial University's results.

Sub-objective 1.3.: To analyse the relationship between entrepreneurship support mechanisms and Entrepreneurial University's results.

Although the Entrepreneurial University is a term now being used to refer to universities which possess a wide range of new support mechanisms for fostering entrepreneurship within itself (Jacob et al., 2003), little is known about how these entrepreneurship support mechanisms contribute to the emergence of the Entrepreneurial University (Guerrero et al., 2011).

In this sense, Coduras et al. (2008) assumed that the use of entrepreneurship support mechanisms could have positive effects on Entrepreneurial University's results, supporting the generation and exploitation of entrepreneurial initiatives (Toledano and Urbano, 2008).

This approach gave rise to the third hypothesis:

Hypothesis 3: Entrepreneurship support mechanisms influence positively and significantly on Entrepreneurial University's results.

Specific Objective 2: To analyse the impact of each entrepreneurship support mechanism on Entrepreneurial University's results.

Sub-objective 2.1.: To describe the impact of entrepreneurship support mechanisms on Entrepreneurial University's results.

As it was shown previously, the use of entrepreneurship support mechanisms could have positive effects on Entrepreneurial University's results, thus it could be interesting to analyse each entrepreneurship support mechanism independently. Indeed, through the literature review, ten entrepreneurship support mechanism were identified as the most influential ones (see Section 3.2). Specifically, it is worth highlighting that among them there are two entrepreneurship support mechanism, the incubator and the technology parks, which had a huge presence within the Entrepreneurial University's literature.

Indeed, Entrepreneurial Universities seek to established incubators and/or technology parks to provide support (Etzkowitz, 2003c) for the creation of spin-off firms (Chrisman et al., 1995) and to aid academics in the commercialisation of their research (Jacob et al., 2003, Kirby et al., 2011).

This approach gave rise to the next three hypotheses:

Hypothesis 4: Universities that promote more entrepreneurship support mechanisms obtain higher values on Entrepreneurial University's results than the rest.

Hypothesis 5: Universities engage with an incubator obtain higher Entrepreneurial University's results than the rest.

Hypothesis 6: Universities engage with a technology park obtain higher Entrepreneurial University's results than the rest.

The next two sub-objectives and its consecutive hypotheses were closely related to the previous sub-objective, since its aim was to analyse the impact of entrepreneurship support mechanisms on both types of Entrepreneurial University's results, Hard AEA and Soft AEA. It was interesting to do this division considering that prior research on UBC indicated that universities with closer ties to industry exhibit higher Entrepreneurial University's results than the rest (Roberts and Malone, 1996, Gulbrandsen and Smeby, 2005, Prodan and Drnovsek, 2010). Thus, it was necessary to analyse if there was any difference between the universities which obtain more Hard AEA and the ones that obtain more Soft AEA.

This approach gave rise to the next two sub-objectives and their consecutive hypotheses:

Sub-objective 2.2.: To analyse the impact of entrepreneurship support mechanisms on Hard Entrepreneurial University's results (Hard AEA).

Hypothesis 7: Universities which obtain higher values on Hard AEA have significantly higher values on some specific entrepreneurship support mechanisms.

Sub-objective 2.3.: To analyse the impact of entrepreneurship support mechanisms on Soft Entrepreneurial University's results (Soft AEA).

Hypothesis 8: Universities which obtain higher values on Soft AEA have significantly higher values some specific entrepreneurship support mechanisms.

Sub-objective 2.4.: To estimate a predictive model and identify the entrepreneurship support mechanisms which must be influenced in order to evolve a university from their current scenario in Entrepreneurial University's results to a superior one.

This sub-objective did not imply any hypothesis, since this was a model estimation based on entrepreneurship support mechanisms. Indeed, a predictive model estimation was done using two different statistical techniques, the discriminant function analysis and the multiple linear regression. Moreover, the Entrepreneurial University's classification (Hard AEA and Soft AEA) was taken into account.

Specific Objective 3: To develop a universities' taxonomy depending on Entrepreneurial University's results.

As it was shown before, prior research on UBC indicated that universities with closer ties to industry exhibit higher Entrepreneurial University's results than the rest (Roberts and Malone, 1996, Gulbrandsen and Smeby,

2005, Prodan and Drnovsek, 2010). Therefore universities were classified depending on their Entrepreneurial University's results and the most influential entrepreneurship support mechanisms for each universities group were identified.

This approach gave rise to the last two hypotheses:

Hypothesis 9: Universities that pursue Soft AEA developed different entrepreneurship support mechanisms from the ones that pursue Hard AEA.

Hypothesis 10: Universities that are above the mean regarding Hard AEA, are the ones that obtain the worse values on Soft AEA.

4.3   RESEARCH METHODOLOGY AND METHODS

The literature review and the emergence of an Entrepreneurial University research framework in previous chapters represented the initial steps in the development of the theory and testing of the key factors of an Entrepreneurial University. From this baseline, the present chapter discussed the established research methodologies and design.

The research design is a general plan of how the researcher intended to answer the research questions (Saunders et al., 2011). Moreover, the research design entail defining the nature of the methodology to be implemented, as well as the strategies, instruments, and data collection and analysis methods. Specifically, the elements of the research design addressed in this chapter included purpose of research, research strategy, unit of analysis, sampling strategy, research methods and data analysis. The chapter concluded by determining whether the selected methodology was suitable in serving the purpose of this research.

The research design for the present research consisted of an explanatory research that was analysed through quantitative methods. A self-devised questionnaire was used in order to measure the importance of the different factors within an Entrepreneurial University and their impact on Entrepreneurial University's results. The summary of the methodology adopted to address the research design is shown through Figure 13.
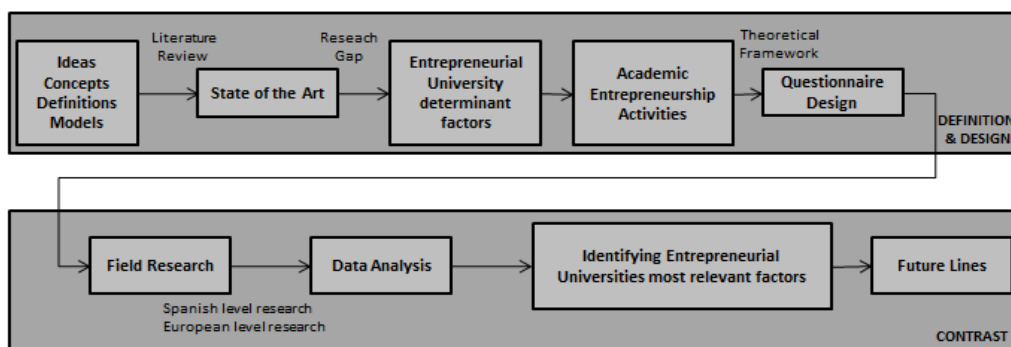
Figure 13 Research Design

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4.3.1   Research methodology

The research methodology is a way to systematically solve the research problem (Kothari, 2004). In other words, it is the path for finding answers to the research questions (Kumar, 2012); which is conducted in terms of the research philosophy subscribed to, the research strategy employed and so the research instruments utilised (and perhaps developed) in order to pursuit of the research objective(s). Thus, the purpose of this section is to:

- Discuss the research philosophy in relation to other philosophies.
- Expound the research strategy, including the research methodologies adopted.
- Introduce the research instruments that have been developed and utilised in the pursuit of the goals.

For achieving these triple objective, Saunders et al. (2011)'s research onion procedure was followed (see Figure 14) which involved questions on the research philosophy, research approach, research strategy, methods for data collection and approach to data analysis (Mariussen, 2011).
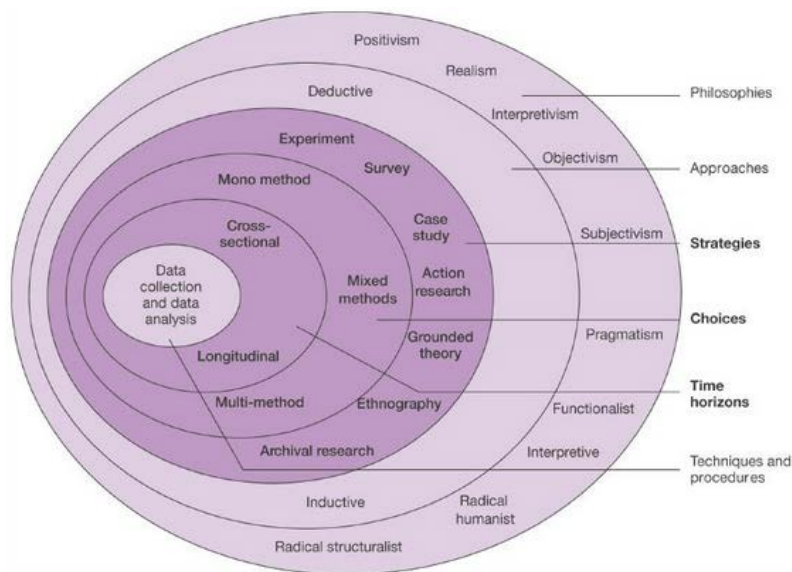
Figure 14 The research "onion" (Saunders et al., 2011)

Research philosophy

A research philosophy is a belief about the way in which data about a phenomenon should be gathered, analysed and used. Two major research philosophies have been identified by the Western tradition of science, namely positivist (sometimes called scientific) and interpretivist (also known as antipositivist) (Galliers, 1992); although there are more.

If the research philosophy reflects the principles of positivism then it will probably adopt the philosophical stance of the natural scientist. The researcher will prefer "working with an observable social reality and that the end product of such research can be law-like generalisations similar to those produced by the physical and natural scientists" (Remenyi et al., 1998). Only the phenomena that the researcher can observe will lead to the production of credible data. To generate a research strategy to collect these data the researchers are likely to use existing theory to develop hypotheses. These hypotheses will be tested and confirmed, in whole or part, or refuted, leading to the further development of theory which may then be tested by further research.

The researchers may be critical of the positivist tradition and argue that the social world of business and management is far too complex to lend itself to theorising by definite "laws" in the same way as the physical sciences. Those researchers critical of positivism argue that rich insights into this complex world are lost if such complexity is reduced entirely to a series of law-like generalisations. If the researcher sympathise with such a view the research philosophy is likely to be nearer to that of the interpretivist. More specifically, interpretivism is an epistemology that advocates that it is necessary for the researcher to understand differences between humans in our role as social actors. This emphasises the difference between conducting research among people rather than objects such as trucks and computers.

To summarise, the ontological position of this study was that social world could be perceived in objective manner, the researcher was an objective analyst. Therefore, reality could be studied to a certain extent and generalisations could be made with a degree of probability.

Research approach

Founded upon different research philosophies, research approaches provide an informed choice and a more practical guide for the overall configuration of the research (Saunders et al., 2011). The extent to which the researcher was clear about the theory at the beginning of the research was the key distinction between the *deductive* and *inductive* approaches. In the deductive approach, research involves the development of a theory that is subjected to a rigorous test. Conversely, followers of the inductive approach build theory in an inductive way: theory follows the data rather than the contrary, as in the deductive approach (Collis and Hussey, 2003). The main differences between the two approaches were grouped in Table 29.

By adopting a positivistic view, the present study showed a focus on theory testing wherein theory was first adopted as the framework for developing and testing hypotheses in a specific research context. This emphasised deductive orientation of the present study.

Table 29 Differences between deductive and inductive approaches

Deductive approach	Inductive approach
-Scientific principles	-Gaining an understanding of the meanings humans attach to events.
-Moving from theory to data	
-Explaining causal relationships between variables.	-A close understanding of the research context.
-The collection of quantitative data.	-The collection of qualitative data.
-A highly structured approach	-A more flexible structure.
-Researcher independence to what is being researched.	-The researcher is part of the research process.
-The necessity to select samples of sufficient size in order to generalise conclusions.	-Less concern with the need to generalise.

Research design or strategy

Different authors have different opinions on what a research design includes (Yin, 1989, Robson, 1993, Janesick, 1994, Hernández et al., 2006), but all agree that a research design or strategy is the guideline of how to obtain the goal of the research statement presented. By suggesting that the decision on the research strategy is based on the types of research questions, the degree of control over actual events, or the focus on contemporary or historical events. Besides, the research design or strategy alternatives are many (see Table 30).

Table 30 Relevant situations for different research strategies (Yin, 1989)

Research Strategy	Type of research question	Research control over event	Focus on contemporary events
Experiment	How, why	Yes	Yes
Survey	Who, what, where, how many, how much	No	Yes
Archival analysis	Who, what, where, how many, how much	No	Yes/No
History	How, why	No	No
Case study	How, why	No	Yes
Ethnography	Specific research questions addressing the ethnographic focus: What is this?	No	Yes
Discursive method	Questions regarding verbal interaction and dialogue	No	Yes
Grounded theory	An initial grounded theory research question will be quite broad aimed at developing an in depth understanding (Indicating the use of how, why, what)	No	Yes

According to Leedy and Ormrod (2005) there were alternatives such as the creation of an experiment (common in pure scientific research); surveys (often used where large volumes of data are involved with quantitative methods of analysis); grounded theory (where the theory is generated by the observations rather than being decided before the study); ethnography (a phenomenological methodology which stems from anthropology, which uses observed patterns of human activity); action research (where the research takes more of the form of a field experiment); and, finally, case studies (which seek to understand social phenomena within a particular setting).

Given the nature of the research objectives as outlined in Chapter 1, the quantitative approach was followed using the survey as the research strategy; due to the association of this research strategy with the deductive method (Lewis et al., 2009). The deductive method was usually used in business and management studies, since it allowed collecting a large amount of data from a population sample where data were obtained through a questionnaire. This method has some advantages, for instance: a standardized collection of the data, a more structured comparison of the data, a relatively easy implementation and comprehension, and control over the research process.

Time horizon

There are two different types of studies regarding their time horizon (Zikmund, 2003). On the one hand, longitudinal studies collect data from the same sample (a "panel") of people on more than one occasion (usually using the same methods) over a period of time; and on the other hand, cross-sectional studies collect data only once and in one short period, sequences of action and social change over time can be analysed (Payne, 2004). Thus, the time horizon of the research was cross sectional, since the objective of the study was to analyse a particular phenomenon at a particular time.

4.3.2   Unit of analysis

Other important domain in a research is the unit of analysis. The unit of analysis is the major entity that the researcher is analysing in his/her study. It is the "what" or "who" that is being studied. Units of analysis are essentially the things the researcher examines in order to create summary descriptions of them and explain differences among them. Specifically, in social science research, there were several units of analysis that were commonly used, including (see Table 31): individuals, groups, organisations, social artifacts, and social interactions (Babbie, 2001).

Table 31 Different units of analysis (Babbie, 2001)

UNIT OF ANALYSIS	DESCRIPTION
Individuals	Researchers tend to describe and explain social groups and behaviours by analysing and aggregating the behaviours of individuals.
Groups	A researcher may be interested in characteristics that belong to one group, considered as a single entity.
Organisations	If a researcher is studying corporations, the unit of analysis is the organisation (corporation).
Social artifacts	A social artifact is any product of social beings or their behaviour, such as: books, newspapers, paintings, poems…
Social interactions	Social interactions that might be units of analysis in social science research include: court cases, traffic accidents, fistfights, friendship choices, divorces…

Relating to Entrepreneurial Universities literature and the usual units of analysis, Brennan and McGowan (2006) identified the following five levels of analysis:

- Individual: an academic recognised by the university as an entrepreneur.
- Community of practice: an informal social network.
- The academic school: the most basic unit of academic staff for the purpose of university administration.
- University: a grouping of academic schools coordinated through a central faculty structure.
- The entrepreneurship system: the individual and corporate actors who interact in a recognisable context to form the infrastructure for entrepreneurship.

Due to this classification and in order to achieve the main objective of this research, the unit of analyses was an institution, in this case the university. For understanding the effect that certain institutional-level factors could have over the results, the analysis was made also at the institutional-level (Wright et al., 2009). Thus, the university (as an institution) was the unit of analysis of the present research and the Technology Transfer Office Directors (onwards TTO Director) as the person to interact.

4.3.3   Sampling design, selection and size

Antonius (2002) describes the sampling design as the procedure for selecting a sample that specifies the type of sample to be used, the number of units to be selected in the sample as a whole and the method for choosing the units. The concept of sample design is very important since researches involving samples are popular and the quality or value of research is very sensitive to the sample size and the manner in which the sample is selected.

Furthermore, Saunders et al. (2011) state that sampling techniques provided a range of methods that enabled a researcher to reduce the amount of data needed to be collected by considering data from the elements in the population frame. This yields what was commonly known and referred to as population sampling. Specifically, population sampling was a representative selection of some of the elements (subject on which the measurement was being taken) in a population. Moreover, Zikmund (2003) added that a sampling process involved a procedure using a small number of items or parts of the whole population to make conclusions regarding the whole population. Thus, a sample is viewed as the emerging subset or some part of a larger population. It is imminent to define the sample of the study population as a means to providing a sufficient focus of the research efforts of the total study population.

According to Saunders et al. (2011), sampling techniques that are available could be divided into two types namely probability (or representative sampling) and non-probability (or judgemental sampling). Probability sampling is based on the concept of random selection thereby affording the sample a random and equal chance of being selected. Non probability sampling, however, draws its sample arbitrarily thereby depriving the sample from a random selection.

This study was concerned with the precision of the element selection and therefore adopted the probability sampling as its representation basis. The reason for doing so was because probability sampling methods require the use of sampling frames and statistical analysis which can be done to estimate population parameters from sample statistics. They also allow for tests of significance to be done on the results.

Once the unit of analysis and the sampling design were established, the selection of a fraction of the total number of units of interest was made (Limpanitgul and Robson, 2009), since it was uncommon for a research to survey the entire population due to time and financial constraints, especially, when the population is very large.

The sample frame was drawn from the total number of European universities which were promoting entrepreneurship within their institutions. A sample frame was a complete list in which each of the unit of analysis was mentioned only once. According to Cooper and Schindler (2008), sampling was based on two premises. The first premise drawn on the similarities among the elements in the population that adequately represented the characteristics of the total population. The second premise presupposed that in a sample selected, some elements underestimated the value attached to a population whilst others overestimate such a value. The resultant value derived from aspects like arithmetic means provided a good estimate of the population mean. To this end, it was therefore prudent to ensure that a good sample was selected in order for research to be meaningful. The study took cognisance of the advances made by Cooper and Schindler (2008) that a good sample contained the elements of both precision and accuracy. The precision calls for a sampling error that was within acceptable limits for the study's purposes. An accurate sample was obtained in a case in which there was little or no bias or systematic variances.

The sample size was chosen correctly by ensuring that it was large enough, representative and randomly selected to allow a generalisation of the results of the population as a whole. As it was explained in the previous paragraph, the sampling was composed by European universities that were promoting entrepreneurship within their institutions and therefore, due to the novelty of this subject, they were participating in international conferences in order to disseminate their learning and best practices. Thereby, the universities and their respective respondents were selected due to their participation in international conferences related to Entrepreneurial Universities and Entrepreneurial Education (such as FINPIN Conference, UIIN Conference, BCERC Conference, ECSB Entrepreneurship Education Conference and Global Entrepreneurship Monitor - GEM). In fact, 361 universities from whole Europe were contacted (for detailed information regarding the emailed universities see Annexe D).

4.3.4   Data collection methods

Although there are other distinctions in the research methods, the most common classification of research methods is into qualitative, quantitative and mixed (see

Table 32). Therefore, anticipating the type of data needed to respond to the research objectives, one out of the three previously mentioned approaches was selected to conduct the study.

Table 32 Quantitative, qualitative and mixed methods research characteristics

Qualitative Research	- Based on meanings expressed through words - Results in non-standardised data requiring categorisation into categories - Analysis conducted through the use of conceptualization
Quantitative Research	- Based on meaning derived from numbers - Collection results in numerical and standardised data - Analysis conducted through the use of diagrams and statistics
Mixed Research	- Mixes the best of qualitative and quantitative research - Takes an eclectic, pragmatic, and common sense approach - Uses both deductive and inductive methods

Researchers typically select the quantitative approach to respond to research questions requiring numerical data, the qualitative approach for research questions requiring textural data, and the mixed methods approach for research questions requiring both numerical and textural data. The present research employed a quantitative approach, since it was used in response to relational questions of variables within the research (Williams, 2011). Moreover, quantitative research used mathematical models as the methodology of data analysis, which was one of the main objectives of the present research.

Regarding the research methodologies employed in the Entrepreneurial University literature, Markuerkiaga et al. (2014) based on the classification drawn up by Seuring and Müller (2008), showed that the 45% are case study papers, the 25% are surveys and the rest 30% are theoretical papers (e.g. reviews). Thereby, addressing a research on Entrepreneurial Universities based on a quantitative approach is quite common, although the case study is the most used methodology.

Once the quantitative research method was selected, the data collecting methods selection was addressed. According to Williams (2011) quantitative research involves the collection of data so that information can be quantified and subjected to statistical treatment in order to support or refute the research hypotheses. From this baseline, data could be collected in the form of primary or secondary data (Groenewald, 2010). Primary data, according to Zikmund (2003), refers to data gathered and assembled specifically for research development and can be collected by means of questionnaires, surveys, checklists, interviews, documentation review, observation, focus groups and case studies (Coldwell and Herbst, 2004). On the other hand, secondary data refers to data that have been previously collected for some purpose other than the one of the working research (Zikmund, 2003). Various authors identified different forms of secondary data, such as: major indexes, reference guides, census data, statistical data, market data, industry data, corporate directories, international sources, textbooks, magazines and newspaper articles, among other (Zikmund, 2003, Cooper and Schindler, 2008).

For the present study, primary data collection was established as the unique data collection method; since all the data was acquired from the source (the TTO director). Furthermore, as it was mentioned before, there were different methods of collecting primary data (see Table 33) and, among them, the questionnaire survey was used as the main data collection instrument of this study because the questionnaire survey enabled researchers to examine and explain relationships between constructs, in particular cause-and-effect relationships (Saunders et al., 2011).

Table 33 Mainly used primary data collection methods (Babbie, 2001)

DATA COLLECTION METHOD	DESCRIPTION
Survey	They are useful in describing the characteristics of a large population and make large samples feasible. In one sense, these surveys are flexible, making it possible to ask many questions on a given topic. This also provides flexibility in the analysis of the responses. On the other hand, standardized questionnaire items often represent the least common denominator in assessing people's attitudes, orientations, circumstances, and experiences. By designing questions that will be appropriate for all respondents, it is possible to miss what is most appropriate to many of the respondents.
Interview	The interview is an alternative method of collecting survey data. Rather than asking respondents to fill out surveys, interviewers ask questions orally and record respondents' answers. This type of survey generally decreases the number of —do not know and —no answer responses, compared with self-administered surveys. Interviewers also provide a guard against confusing items. If a respondent has misunderstood a question, the interviewer can clarify, thereby obtaining relevant responses.
Focus Groups	Focus groups are useful in obtaining a particular kind of information that would be difficult to obtain using other methodologies.

Regarding the survey as the data collection method, it is a tool for eliciting information which can be tabulated and discussed; serving as the major source of information (Taylor-Powell, 1998). Moreover, this survey could be composed by open and ended questions. On the one hand, open-ended questions allowed respondents to provide their own answers. This gives them the opportunity to express their own thoughts, but also required more effort in terms of their responses. In addition, open-ended questions tended to produce varieties of answers and were more difficult to analyse. On the other hand, close-ended questions listed answers, and respondents select either one or multiple responses. Moreover, these questions produced more uniform answers than open-ended questions.

The election of using open- or close-ended questions within the questionnaire depends on the degree to anticipate the possible answer, the time available for encoding the data and the requirement of a more accurate response or not. For this research, the questionnaire used included closed questions dichotomous (true/false), and polytomous (a five-point Likert scale, with five being the most important and one rating the less important) scales. For more information regarding the variables and its typology see Section 4.4.

The research instrument

As explained in Chapter 2, through the literature review the factors that made up an Entrepreneurial University and the Entrepreneurial University's results were identified. In addition to develop these tasks, the items used for measuring these factors were identified within this revision. Thereby, a survey instrument entitled *"European Entrepreneurial Universities Scorecard"* was self-developed (a full copy of the English version of the final questionnaire used in the study and the presentation letter developed to introduce the subject are attached in Annexe B and Annexe C).

Dillman (2007) points out that the questionnaire's design (respondent-friendly questionnaire) has an impact on response rates and on measurement error. Poor questionnaire layout can cause questions to be overlooked or can bias the offered responses. A respondent-friendly questionnaire is attractive and encourages people to reads words in the same order as other respondents read them. People are guided by graphic layout features, from the cover page through the last question. A well-designed layout prevents items or answer categories from being missed (Dillman, 2007).

These are some design aspects which have been followed for the questionnaire development:

- The use of guidelines for ordering the questions.
- The placement of instructions exactly where they are needed.
- The use of increased font sizes for certain written elements to attract attention (e.g. question numbers).
- The maintenance of simplicity, regularity, and symmetry.
- The use of bold text for questions and light text for answer choices.
- The separation of optional or occasionally needed instructions from the question statement by font variation; italic font, smaller size, and text between brackets were used for notes.
- The use of the vertical alignment of question subcomponents.

In order to encourage people to read and answer the questionnaire, the layout of the questionnaire was taken into consideration. It was configured around a set of questions about the variables to be measured (see Figure 15), grouped into related blocks, considering the easiest way for the respondent for concept association (the origin of each item is described in the Annexe A). Furthermore, this questionnaire consisted of closed questions, dichotomous (true/false) and polytomous (a five-point Likert scale, with five being the most important and one rating the less important); and was taken into account the profile of the person who should answer it, in this case the TTO directors.

University Identification	Country; Name of your University; The ownership status; Areas of research activity
Entrepreneurship Support Infrastructures	An Incubator; A Central support unit for Entrepreneurship or an Entrepreneurship Centre; An Entrepreneurship Programme; A Business Plan Competition; Undergraduate degree in Entrepreneurship; Graduate degree in Entrepreneurship; PhD degree in Entrepreneurship ; An Entrepreneurship Doctoral Programme; An Entrepreneurship Research Chair; An affiliated Science/Technology Park; A Technology or Engineering Faculty/School.
Entrepreneurial University's Results	Information dissemination; Networking; Industry Training Courses; Industry Mobility; Consulting; Contract Research; Patent & Licenses; Academic Spin-offs; Student Spin-offs.
Environmental factors	Industrial Context; Institutional Context.
Organisational factors	Mission & Strategy; Management Support; Organizational Design.
Entrepreneurship Support Mechanisms	Policies; Industry presence on Curriculum development & delivery; Internationalisation; Funds for Entrepreneurship; Entrepreneurship Education; Active Teaching Methodologies; Extra curricular Entrepreneurship Activities; Staff development in Entrepreneurship.

Figure 15 Questionnaire layout

Questionnaire translation and pre-testing

Once the questionnaire was finished, it was subject to translation and pretesting. In international research, translation is extremely important, especially if the questions are to have the identical meaning to all participants (Saunders et al., 2011). Back translation is the most commonly used method in multi-country research. Indeed, this technique was applied through the present research; developing the first version of the questionnaire in English, then translating it into Spanish and finally, translating it again into English.

The next step was the pre-testing, the administration of the questionnaire to a small but representative sample of potential respondents under conditions that were identical in all respects to those under which the final questionnaire will be administered (Chapman and Singh, 2011). This pre-testing was done by getting the initial response and a subsequent interview with 6 experts from different positions and profiles, such as deans, TTO directors, academic coordinators and entrepreneurship teachers, in order to identify areas where the questionnaire could needed corrections (Fatoki and Asah, 2011). This decision was made since there are some questions regarding specific topics (e.g. entrepreneurship education or teaching methodologies) that could be better formulated by experts on the topic. Therefore, various suggestions were incorporated to make a final questionnaire for the study.

Data collection procedure

Online data collection methods have become increasingly attractive to researchers (Asaad, 2011), thanks to its several advantages: (i) unrestricted compass: wide

geographical coverage, (ii) low cost of sending out e-mails and faster responses, (iii) higher response rates over postal surveys and (iv) convenience for the respondent. The present research used a self-administered e-mail questionnaire to collect data for the survey from TTO directors from the targeted universities. E-mail surveys are a practical, cost-free and suitable data collection method as this study involves a probable wide geographical dispersion of respondents.

Regarding the present research, the process of collecting questionnaires online lasted five months, with a monthly reminder during the first three months. In fact, out of the 361 surveys mailed sixty-nine were returned (19,11%). In Annexe D there are shown the surveyed universities.

4.3.5   Data analysis methods or techniques

After data was collected in the research, the data analysing and interpreting stage started (Robson, 1993). For the correct development of the research, argued through the previous sections, a quantitative research methodology was established. Thus, in the present section the data analysis techniques used are explained.

Prior to assessing the measurement scales, validity and reliability of the instrument were explored; incorporating an exploratory factors analysis (onwards, EFA) in order to improve the validity and reliability (Cronbach's alpha) (Parsian, 2009). Moreover, Skewness and Kurtosis were tested for normal data distribution. Then, descriptive statistics were conducted with the assistance of SPSS Version 20.0 for Windows (Statistical Package for Social Science), developed by the University of Chicago and one of the most widespread. In order to reveal the central tendency and dispersions of the variables, the mean and the standard deviation were initially calculated.

Subsequently, a variance-based SEM approach, specifically, the Partial Least Squares (onwards PLS-SEM) approach, was used to analyse the model. Thus, data from the survey was performed in SmartPLS 2.0M3 (Ringle et al., 2005), due to the following two main reasons:

   i.   PLS-SEM is more rigorous at estimating the previously presented, compared with regression analyses (Mintu-Wimsatt and Graham, 2004), since it enables the simultaneous testing of the structural component and measurement component in one model (Esposito Vinzi et al., 2010).

   ii. PLS-SEM can accommodate small sample sizes (Chin and Newsted, 1999, Hair et al., 2013). This feature was crucial to the present research as sixty-nine respondents were available for model testing.

Furthermore, the study followed a two-step approach as recommended by Henseler et al. (2009) and Asaad (2011): (i) assessment of the measurement model and (ii) assessment of the structural model. The first step was to develop an acceptable measurement model prior to assessing the structural model. A PLS-SEM approach was followed to examine the properties of scales such as internal

consistency reliability, convergent validity, discriminant validity, and unidimensionality for reflective scales, and significance of weights and multicollinearity for the formative measure. Then, at a later stage, the structural relationships among constructs were examined.

After using the PLS-SEM approach, independent samples *t*-test, analysis of variances (onwards, ANOVA), cluster analysis, discriminant function analysis and the multiple linear regression were applied in order to test the research hypothesis and achieve the research objective. For these analyses, the SPSS software was used again.

4.4   VARIABLES OF THE EMPIRICAL STUDY

Regarding the variables that composed the research, almost every variable of the study was constructed based on a 5-point Likert scale; in order to simplify the statistical analysis (see Table 34). However, there were two variables (incubator and technology park) which were measured using a dichotomous variable.

Table 34 Measurement scales

Construct		Nº of Items	Scale type
First ord.	Second ord.		
External	Institutional Context	5	5-point Likert Scale
	Industrial Context	4	5-point Likert Scale
Internal	Mission & Strategy	4	5-point Likert Scale
	Management Support	4	5-point Likert Scale
	Organisational Design	4	5-point Likert Scale
Entrepreneurship Support Mechanisms	Policies	3	5-point Likert Scale
	Internationalisation	4	5-point Likert Scale
	University support through the whole entrepreneurship process	4	5-point Likert Scale
	Industry Presence in Curriculum D&D	4	5-point Likert Scale
	Funds for Entrepreneurship	6	5-point Likert Scale
	Entrepreneurship Education	3	5-point Likert Scale
	Staff Development in Entrepreneurship	3	5-point Likert Scale
	Active Teaching Methodologies	3	5-point Likert Scale
	Incubator	1	Dichotomous
	Technology Park	1	Dichotomous
Entrepreneurial University's results	Information Dissemination	3	5-point Likert Scale
	Networking	3	5-point Likert Scale
	Mobility with Industry	4	5-point Likert Scale
	Consulting	1	5-point Likert Scale
	Industry Training Courses	1	5-point Likert Scale
	Collaborative research	3	5-point Likert Scale
	Patents & Licenses	3	5-point Likert Scale
	Students Spin-offs	4	5-point Likert Scale
	Academics Spin-offs	5	5-point Likert Scale

The original idea for the Likert scale is found in Rensis Likert's 1932 article in Archive of Psychology titled, "A Technique for the Measurement of Attitudes" (Edmondson, 2005) and it is one of the oldest methods widely used (Camparo, 2013). This scale is a structured primary data collecting instrument, which is generally used for ordinal variable measurement, is organised through a number of items or statements concerning the intensity of the variables to be measured (Díaz, 2014).

This scale assumes that all items could be measured with the same intensity and the respondent gives a score according to its approval or disapproval. This is usually expressed in values between one and five, depending on the respondents´ perspective against the statement suggested by the item. Specifically, for the present research Taylor-Powell (1998)'s five level close-ended questions scale (Table 35) was used.

Table 35 5-point Likert scale (Taylor-Powell, 1998)

5 levels				
1 Strongly disagree	2 Mildly disagree	3 Neither agree or disagree	4 Mildly agree	5 Strongly agree

4.4.1 Independent variables

In the present section there is shown the description of each independent variable and the items for measuring it. Independent variables are those that having an independent behaviour influence dependent variables; thus the final outcome is determined by them. The used independent variables were identified from the literature review, since they were mentioned (by many authors) over the last ten years as possible influential of Entrepreneurial Universities; these factors composition is described in the following lines.

Institutional Context [INST_CONTEXT]: Universities nowadays are operating within an Innovation System, interacting with firms and governmental institutions in order to become an Entrepreneurial University (Etzkowitz, 2004). Dealing with this issue, there were consistent studies which suggest that university entrepreneurship policies, along with government commitment, were the leading drivers affecting a university's innovation performance where University – Industry – Government linkages are involved (Hu, 2009).

One of the most important milestones for this progress was the Bayh-Dole-Act, which provided a mechanism by which the intellectual property generated under federal research grants could become universities' property. The core logic behind transferring these rights was that it would facilitate the dissemination of knowledge by allowing universities to transfer intellectual property quickly to the larger community (Wood, 2011). Besides, at early 1990s, structural changes in the external environment of European universities (e.g. legislative chances) pushed them to a more proactive role in technology transfer (Baldini et al., 2007, Fini et al., 2009).

Another diffused form of government intervention was the provision of financial incentive; both for entrepreneurship education (in order to foster the establishment of new ventures and the knowledge and technology transfer from university to market) (Guenther and Wagner, 2008) and for academic spin-off firm formation (Fini et al., 2009). Governments could play a vital role in creating funding mechanisms for programmes, activities and initiatives associated with entrepreneurial education (Volkmann et al., 2009).

To calculate this construct, the following four items were considered and assessed with a Likert 5-point scale:

- Degree to which your institutional context is supportive for entrepreneurial activities.
- Degree to which your Government has made legislative changes in order to create necessary conditions for entrepreneurship.
- Degree to which your Government encourages universities to focus directly on technology commercialization and spin-off activity.
- Degree to which your Government provides financial incentives for entrepreneurship.

Industrial Context [INDUS_CONTEXT]: A supportive local-context seems to be really necessary for the path towards the Entrepreneurial University. The local context in which a new venture decides to operate may be seen as a set of skills and resources that are both tangible (physical infrastructure, corporate physical assets, R&D laboratories) and intangible (human capital, routines, etc.), thus the external factors related to an Entrepreneurial University are important for its promotion. However, there are few studies which have looked at how specific environments may influence entrepreneurship (Rasmussen et al., 2012).

In recent years, the role of incubators and science parks as tangible and intangible resource providers has gained more and more importance (Guenther and Wagner, 2008); due to the prestige they bring to the spin-off firms (Looy et al., 2003, Rothaermel et al., 2007, Kirby et al., 2011).

In addition to the previously mentioned resources, there are more forms of supportive mechanisms that the local context could offer. On the one hand, different studies show that the level of financial development makes growth and expansion possible and that these effects are particularly relevant for small and young firms (Fini et al., 2009, Kirby et al., 2011). On the other hand, local context also might develop specific entrepreneurial support services directly targeted at helping new ventures in their early stages of life.

Highlight that another local-context supportive factor for new ventures is the closeness to research centre and universities (Fini et al., 2011). Besides, mention that, arising from the agglomeration of companies in the same territory appears the so-called "role model" or "contagion effect" (Shane, 2004b). Indeed, a role model is a common reference to individuals who set examples to be emulated by others and who may stimulate or inspire other individuals to make certain decisions and achieve certain goals (Bosma et al., 2012); which also could occur at the institutional level.

Furthermore, the industrial composition of a specific territory could determine significant business opportunities. The availability of companies operating in the same or related sectors promotes the natural exchange of ideas through formal and informal networks. This closer interaction between companies helps to create a social environment that supports and encourages individuals to share knowledge and ideas (Fini et al., 2009). From the point of view of the university, it is really

favourable to do research on the same industrial sector of its most nearby businesses.

To calculate this construct, the following five items were considered and assessed with a Likert 5-point scale:

- Degree to which your nearest business sectors are appropriate for commercial exploitation.
- Degree to which your local context is fertile for NTBF.
- Degree to which your University surrounding industry has High Technology level.
- Degree to which your University surrounding industry works within sectors with immature technologies (software, microelectronics, multimedia…).
- Degree to which your University surrounding industry has high budget for R&D.

Mission & Strategy [STRATEGY]: Mission and strategy represents university's overall strategic philosophy or orientation concerning the likely trade-offs between market share growth and short term profits (Covin and Slevin, 1991). Clark (1998) stated that one of the key elements of the Entrepreneurial University is pursuing a clearly defined strategy. This includes that any university mission statement and published strategies should embrace the word "enterprise" or "entrepreneurship" (Etzkowitz, 2004, Kirby, 2006, Gibb, 2012); thus, the notion of "enterprise" or "entrepreneurship" is accepted as part of the "sense" of the university and each of its employees share a common vision for the creation of an Entrepreneurial University (Peterka, 2011).

For example, Bratianu and Stanciu (2010) describe the Entrepreneurial University mission as the follow: "The mission of the Entrepreneurial University is that of preserving and enriching national and universal culture, its target is training and forming specialists and its objectives are correct and clear reactions to the requirements of the society they are part of".

To calculate this construct, the following four items were considered and assessed with a Likert 5-point scale:

- Degree to which Entrepreneurship Education is linked to your University goals.
- Degree to which your University has a Technology Transfer Strategy.
- Degree to which Entrepreneurship is seen as central in your University strategy.
- Degree to which University Business Cooperation is seen as central in your University strategy.

Management Support [MANAG_SUPPORT]: The increase of Entrepreneurial University's results imply a review and/or reinforcement of some organisational level factors, such as institutional strategies, market oriented institutional policy,

links with the industrial sector, strong leadership of the top management team, among others (Yokoyama, 2006).

In fact, organisational behaviours and performances are a reflection of the traits of the members of the top management team, which influence university strategy, through the impact on group decision making processes (Miller and Katz, 2004, Visintin and Pittino, 2010, Gibb, 2012). Furthermore, according to Todorovic et al. (2005) the nature and strength of leadership in supporting an entrepreneurial culture in the university is essential, empowering the strength, compactness and credibility of the management team (Ackroyd and Ackroyd, 1999, Bleiklie and Kogan, 2007, Gibb, 2012). Thus, the understanding of, and support from, the management team for the entrepreneurship concept is necessary for an Entrepreneurial University (Gibb, 2012).

To calculate this construct, the following four items were considered and assessed with a Likert 5-point scale:

- Degree to which the Dean and executive team support entrepreneurship.
- Degree to which Entrepreneurship has presence on your University agenda.
- Degree to which your University governance structure is able to adapt to environmental changes.
- Degree to which your Deans and Heads are proactive in fund and revenue raising.

Organisational Design [ORGANI_DESIGN]: An university's organisation can be designed to constrain entrepreneurial behaviour or to facilitate it (Gibb and Hannon, 2005). Based on this affirmation, Gibb (2012) identified some key factors related to the organisational design of a university which foster the entrepreneurial behaviour within it, such as the levels of decentralisation of decision making and the responsibility for strategies as well as operations, the associated flexibility in integrating strategies and action and the degree to which individuals, bottom-up, are empowered to innovate, among others. Indeed, all these characteristics latten the traditional pyramid structure, facilitates the flow of information to all parts of the organisation and reduces response time to external and internal demands (Orlikowski, 2009); transforming the traditional organisational design into a contemporary organisational design. Besides, as Bratianu and Stanciu (2010) stated, universities' institutional transformation towards the Entrepreneurial University cannot be forced top-down, it can only be the result of an internal movement of those living the university reality on a daily basis.

Furthermore, as it was gathered within the previous section, an Entrepreneurial University is focused on a market oriented philosophy, seeking flexibility in order to respond to a rapidly changing market (Yokoyama, 2006, Guerrero et al., 2011); thus, it is essential to adapt its organisational design.

To calculate this construct, the following four items were considered and assessed with a Likert 5-point scale:

- Degree to which your University organisation design creates a connection between teaching and research.
- Degree to which your University organisation design facilitates decentralized decision making.
- Degree to which your University Deans and Heads are proactive in fund and revenue raising.
- Degree to which your University revenue raising activity is delegated to departments.

Policies regarding Entrepreneurship [POLICIES]: Literature assesses the influence of university policies, procedures and practices on Entrepreneurial University's results (O'Shea et al., 2005). According to Rothaermel et al. (2007)'s review, university policies on intellectual property strategy, networking activities and resource endowments play as key factors into the success of spin-offs firms. Di Gregorio and Shane (2003) also agree with the previous statement, since they have confirmed that universities which adopt certain policies (such as incentives for entrepreneurship activity) could generate more spin-off firms. In particular, their research suggested the importance of the following four policies:

- The distribution of royalty rates between inventors and the university could influence the propensity of entrepreneurs to found firms to exploit university inventions.
- The use of incubators could influence the cost of spin-off firms' activity.
- The use of internal venture capital funds could make the acquisition of capital easier for spin-offs.
- University's willingness to take an equity stake in spin-off in exchange for paying patenting, marketing, or other up-front costs could facilitate the formation of spin-off firms.

Although an improvement on entrepreneurship policies was done; proper incentives, assessment, rewards and recognition must be put in place to encourage and motivate faculty staff and educators in supporting students interested in entrepreneurship, and acknowledge the academic value of research and activities in the entrepreneurial field (European Commission, 2008).

To calculate this construct, the following three items were considered and assessed with a Likert 5-point scale:

- Degree to which your University policies and regulations support Technology Transfer.
- Degree to which your University policies and regulations support NTBF creation.
- Degree to which your University policies and regulations support University-Business Cooperation.

Internationalisation [INTERNATIONALISATION]: Internationalisation and the Entrepreneurial University are two concepts that have received considerable attention as separate and distinct phenomena; however, the interface of these two concepts has seen limited analysis, despite the fact that there is much to suggest important synergies between them (Larionova, 2012).

An Entrepreneurial University views internationalisation as a key tool, and is able to plan and strategically manage its internationalisation, effectively assessing the environment and its own strengths and weaknesses. Specifically, the internationalisation of higher education is a key part of the scenario in the Entrepreneurial University (Gibb, 2012). Indeed, the recognition of the value of mobility (beyond the local level to the international plane) of students, academics and industrial collaborators in developing and enhancing Entrepreneurial Universities is essential (Allinson et al., 2012, Gibb, 2012).

Moreover, the internationalisation process may also provide new rewards in terms of income, reputation, research opportunity, new partnerships and enhanced cultural understanding (Gibb, 2012).

To calculate this construct, the following four items were considered and assessed with a Likert 5-point scale:

- Degree to which your University is focused upon internationalisation.
- Degree to which your University has International research and development links.
- Degree to which your University has overseas joint degrees.
- Degree to which your University has high revenue from International activity.

University support for the Entrepreneurship Process [E_CURRI_ACTIVITIES]: The academic entrepreneurship process is essential for an Entrepreneurial University, however little attention was directed to the nature of this process (Prodan and Drnovsek, 2010). Academic entrepreneurship is not a single event, but rather a continuous process comprised of a series of events (Friedman and Silberman, 2003). As a deeper understanding of academic entrepreneurship may be achieved through the development of a multi-stage process model that identifies the key actors, activities, potential stakeholders and key success drivers associated with each stage of the innovation commercialisation process (Salamzadeh et al., 2011, Wood, 2011).

Plaschka and Welsch (1990) defined a framework, which follows a thirteen stages process, where the transition stages of the entrepreneurial process can be visualized around challenges, deficiencies, and crises (see Figure 16).
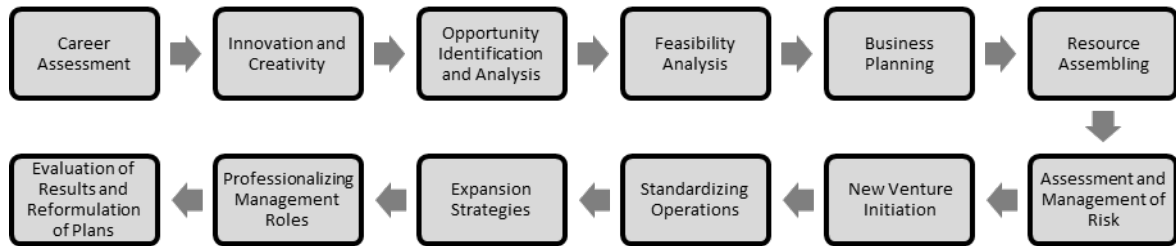
Figure 16 Academic Entrepreneurship Process (Plaschka and Welsch, 1990)

To calculate this construct, the following four items were considered and assessed with a Likert 5-point scale:

- Degree to which your University provides support in Identifying Opportunities.
- Degree to which your University provides support in Business Plan Development.
- Degree to which your University provides support along the Patent Process (disclosure, patent applications, etc.).
- Degree to which your University provides support for Spin-off Initiation.

Industry presence in Curriculum Development & Delivery [INDUS_CURRI]: The industry presence in curriculum Development and Delivery (onwards D&D) is the process of creating a learning environment and the development of human resources relevant to modern society. In fact, this includes university business collaboration in the development of a fixed programme of courses, modules, majors or minors, planned experiences as well as guest lectures by delegates from private and public organisations within undergraduate, graduate, PhD programmes or through further professional education (Davey et al., 2011).

According to De Luca et al. (2014) organisations with good working relationships with a university are in a position to contribute to the curriculum D&D by providing advice on current industry needs and practice. Industry relevant curricula are important for graduate employability as this gives employers confidence in the university and its students and helps students develop and demonstrate appropriate skills.

To calculate this construct, the following six items were considered and assessed with a Likert 5-point scale:

- Degree to which your University involves Business people in University Governance (in curriculum development and delivery).
- Degree to which your University has business people participating in University academic courses.
- Degree to which your University has collaborative education programs with firms.
- Degree to which your University has Business people participating in its advisory boards for directing research agendas.

- Degree to which your University has business people working on its Curriculum development and delivery.
- Degree to which your University has business people as guest lecturers.

Funds for Entrepreneurship [E_FUNDS]: Another mechanism that has received much attention is the creation of university venture funds, fully or partly funded with university resources (Grimaldi et al., 2011). These are meant to provide seed funds for new firms, because it is the major source of funds for new firms in fields in which universities area major source of new technology.

In fact, according to Fini et al. (2009) university venture funds (fully or partly funded by university resources) that generally act at the seed spin-off stages should promote the spin-off firm formation. In contrast, Di Gregorio and Shane (2003) through their study showed that university venture capital funds have an insignificant effect on academic spin-off rates. This could be due to the adequate ties that the university entrepreneurs develop with external venture investors.

To calculate this construct, the following three items were considered and assessed with a Likert 5-point scale:

- Degree to which your University provides resources to fund entrepreneurship teaching and research.
- Degree to which your University ensures a consistent and adequate level of funding for entrepreneurship education programmes.
- Degree to which your University provides economical support for business creation (e.g. seed capital).

Entrepreneurship Education [E_EDUCATION]: In the European Union countries, governmental interest in entrepreneurship education began to be explicit in the Lisbon European Council (Lanero et al., 2011). Indeed, in March 2000, the objective of developing a dynamic enterprising culture and fostering spin-off firm formation as source of sustainable competitiveness in Europe was set (Commission, 2000). Thus, entrepreneurship education was defined as developing specific attitudes, behaviours and abilities on an individual level, which can have different expressions in an individual's career and also creating long term benefits for the society and economy (Bratianu and Stanciu, 2010).

Since then, entrepreneurship education is becoming an important entrepreneurship support mechanisms, due to its potential for promoting the entrepreneurial innovative culture by changing values and basic conceptions (Bratianu and Stanciu, 2010). In addition, experts have indicated that entrepreneurship is teachable (Kuratko, 2005, van der Heide and van der Sijde, 2008), integrative (Hindle, 2007b) and needed on all levels of education (Gibb, 2006). Besides, entrepreneurship education is essential not only to shape the mindsets of young people but also to provide the skills and knowledge that are central to develop an entrepreneurial culture (Bourgeois, 2011).

Despite this political commitment, advances in entrepreneurship education do not follow the same pattern in all regions of the European continent (Lanero et al., 2011). However, little by little, there are more European universities which have some institutional system to disseminate the entrepreneurial culture and give support to new venture creation.

To calculate this construct, the following three items were considered and assessed with a Likert 5-point scale:

- Degree to which your University integrates Entrepreneurship education into the curriculum.
- Degree to which your University encourages the development of research on entrepreneurship and entrepreneurship education.
- Degree to which your University facilitates the provision of direct training and/or support programmes for entrepreneurs.

Staff development in Entrepreneurship [E_STAFF]: Despite the rapid growth of interest in entrepreneurship education, there is still a lack of critical mass of entrepreneurship educators in schools and universities across the world; the current pool of entrepreneurship teachers should be expanded (Volkmann et al., 2009). Growing the base of experienced educators not only means providing the necessary training and education, but also requires expanding the definition of educators beyond professors to include entrepreneurs, alumni, business professionals and even students. Thereby, entrepreneurs and others with entrepreneurial experience should be allowed, encouraged and trained to teach (Wilson, 2008).

Reinforcing the previous idea, Hindle (2001) state that academics who teach entrepreneurship must have a combination of practical and academic skills. Too often, academics from other fields of business management are recruited to coordinate and work on entrepreneurial education, instead of recruit scholars that have been trained specifically or by academics who have researched and practiced entrepreneurship (Moroz et al., 2010).

Nowadays, there are already some international initiatives such as the NCEE (National Centre for Entrepreneurship in Education) from the United Kingdom which has set out a number of associated competencies for students and has developed educator programmes designed to stimulate staff from any department in a university to develop entrepreneurial approaches to their curriculum and programme development (Gibb, 2012).

To calculate this construct, the following three items were considered and assessed with a Likert 5-point scale:

- Degree to which your University provides the appropriate training for all the staff in the area of technology transfer.
- Degree to which your University provides "New venture creation" training for all the staff.

- Degree to which your University provides Entrepreneurship education training for all the staff.

Active Teaching Methodologies [METHODS]: Traditionally, schools and universities were focused on ensuring that students can achieve a secure future employment. Nowadays, however, any education system must prepare students to work in a dynamic, rapidly changing entrepreneurial and global environment (Volkmann et al., 2009); developing students' skills, attributes and behaviour to improve both creative and critical thinking (Guerrero and Urbano, 2010). This new scenario requires a complete paradigm change for academia, changing the fundamentals of how schools and universities operate and how they teach; investing in research and new pedagogies (Moroz et al., 2010).

Regarding new teaching methodologies, active learning methods are a good example (although they are more complex than traditional teaching methods). Active learning methods require engaging students' feelings and emotions in the learning process and developing the creativity, innovation and critical thinking skills of individuals. Educators therefore must be able to create an open environment of trust in which students develop the necessary confidence to take risks by learning from trial experiences with both successes and failures (Volkmann et al., 2009).

In fact, an specific active teaching methodology which needs greater emphasis, is the experiential and action learning with a focus on critical thinking and problem solving (Volkmann et al., 2009). This pedagogy should be interactive, encouraging students to experiment and experience entrepreneurship through working on case studies, games, projects, simulations, real-life actions, internships with start-ups and more activities which involve interaction with entrepreneurs. Moreover, active and learning-by-doing methods integrate elements of practice into the learning process.

To calculate this construct, the following three items were considered and assessed with a Likert 5-point scale:

- Degree to which your University supports the development of entrepreneurship course materials (e.g. cases, books, games, videos).
- Degree to which your University promotes the application of "learning by doing" (e.g., through PBL, internships, consulting).
- Degree to which your University supports the involvement of entrepreneurs and companies in entrepreneurship courses.

Incubator [INCUBATOR]: Although there is still little systematic analysis of the role that an incubators play in facilitating technology transfer (Rothaermel and Thursby, 2005), they have an important role within universities providing knowledge-based assets to spin-off firms. Thereby, nowadays, universities are creating technology transfer facilities such as liaison-offices, incubators, business plan competitions, in order to stimulate faculty, staff and students to become

inventors to start new companies and commercialise their intellectual property (Schillaci et al., 2011).

In the same vein, Entrepreneurial Universities seek to create incubators that provide support (Etzkowitz, 2003c) for the creation of spin-offs (Chrisman et al., 1995) and to aid academics in the commercialisation of their research (Jacob et al., 2003, Kirby et al., 2011). Thus, the existence of a formal function such as an incubator inside the university indicates importance to this activity (O'Shea et al., 2005, Bøllingtoft, 2012). Furthermore, according to some authors, such as Mian (1996), Feldman and Desrochers (2003), O'Shea et al. (2005), Fini et al. (2009) and Grimaldi et al. (2011), incubators located within the university provide some extra services. For example, access to library facilities, access to student labour, a creative environment, exposure to state-of-the-art facilities and expertise, faculty consultants, enhancement of reputation, R&D related activities, etc.

Indeed, incubators essential mission is to assist young and emerging businesses by providing flexible office space, shared equipment and administrative services, however, they also provide a variety of distinct support services, which give rise to different incubation models (Grandi and Grimaldi, 2005). In Table 36 there are shown the main characteristics of an incubator.

Table 36 Key characteristics of Incubators (Bøllingtoft, 2012)

	Characteristics
Physical infrastructure	- Co-location of businesses. - Flexible office space, low priced. - Shared equipment, e.g., access to Internet, printers, meeting rooms, etc.
Shared business-support services	Access to shared support network or services (in the literature also referred to as management assistance, advice or 'coaching').
Network/networking	Access to network in order to e.g. compensate for lack of established networks.
Existence of entry/exit policies	- Screening or admission criteria often related to a business plan and/or compatibility of companies' aims/focus with incubator objective. - Although exit policies are not applied by all incubators, many limit the length of time companies can remain as tenants.

Furthermore, incubators also allow entrepreneurs to develop technologies in close proximity to inventors whose inputs are useful for further development (Di Gregorio and Shane, 2003) and for accelerating the technology transfer. This support mechanism reduces the cost of development through subsidies and sharing of general administrative costs.

Finally, it is worth mentioning that there is another research stream regarding incubators which disagree with the previous assumption and state that the presence of incubators has an insignificant effect on academic spin-off rates (Di Gregorio and Shane, 2003). This is due to potential entrepreneurs, who do not consider the use of incubators when making the spin-off decision. Consequently, the existence of incubators merely shifts the location of spin-offs (to incubators from outside) rather than increasing the amount of them.

To calculate this variable, a dichotomous variable (0-1) was used.

Technology Park [TECH_PARK]: There is not an exact and globally accepted definition of technology park; often synonyms like science parks, business parks, research parks and innovation centres are used (Monck and McLintock, 1988). However, there are some authors that have stated their own definitions; for example, Phan and Siegel (2006) define as technology parks based entities owned with recognisable administrative units in order to accelerate the growth of companies, using the agglomeration of knowledge and sharing of resources among the different entities. On the contrary, Colombo and Delmastro (2002) define technology parks in a more comprehensive way: they are entities based on the property that are intended to foster the emergence and growth of innovative enterprises, foster the transfer of knowledge and skills to these companies and keep closely related to knowledge-generating institutions.

According to Storey and Tether (1998), technology parks have the following roles: (i) to encourage researchers to commercialise the findings of their studies; (ii) provide the existing businesses a close location near knowledge-generating institutions, in order to facilitate relations between these entities; and (iii) provide the existing businesses a close relationship with the university.

In recent years, there was a substantial increase in investment in technology parks and other property-based institutions that facilitate technology transfer. Many universities have established technology parks and incubators in order to foster the creation of spin-off firms based on university-owned (or licensed) technologies. Public universities (and some private universities) also view these institutions as a means of fostering regional economic development (Siegel and Phan, 2005). Furthermore, improving industrial and economic competitiveness has led some European governments, notably in the Netherlands and the UK, to adopt policies to accelerate the transfer of new technologies from the science base in universities to the marketplace (Hagen, 2008).

Nevertheless, some studies (e.g. Siegel et al. (2003) and Ferguson and Olofsson (2004))do not in general support the notion that parks have created considerable added value to the process of university knowledge transfer and engagement in knowledge exchange. They showed that most companies on technology parks are not heavily involved with the university as measured by: active engagement in processes of technology transfer and exchange, joint R&D programmes, hosting of numbers of companies set up by university staff and/or students, and numbers of doctoral and other students working with firms (Angle Technology, 2003).

To calculate this variable, a dichotomous variable (0-1) was used.

4.4.2   Dependent variables

The dependent variables are the outcome variables, those which are looking to obtain a maximum value, and are influenced in varying degrees by the independent variables. There are few studies which measure the Entrepreneurial University (Guerrero and Urbano, 2010). For instance, Guerrero and Urbano (2010) research measures the Entrepreneurial University outcome based on the three missions of the academic institution: teaching, research and economic and

social development. The present research, as it was shown in Section 2.4, established academic entrepreneurship activities as Entrepreneurial University's results; which are described one by one in the following lines.

Information Dissemination [INFO_DISSEMINATION]: A viable academic technology transfer regime is embedded in an entrepreneurial culture, with a fair division of proceeds to stakeholders, and a knowledge management strategy that combines patenting with publication as complementary forms of dissemination (Amesse and Cohendet, 2001, Etzkowitz and Viale, 2010). Furthermore, publishing research papers in collaboration with industry (Perkmann and Walsh, 2007) and developing doctoral thesis in collaboration with industry (Thune, 2009) are also core activities of the Entrepreneurial University.

To calculate this construct, the following three items were considered and assessed with a Likert 5-point scale:

-   Degree to which your University participate in co-authoring research papers with Business people.
-   Degree to which your University has Thesis projects in cooperation with firms.
-   Degree to which your University has collaboration activities facilitating academics interaction with business (e.g., collaborative workshops).

Networking [NETWORKING]: Entrepreneurial Universities are involved in partnerships, networks and other relationships with public and private organisations creating an umbrella for interaction, collaboration and cooperation (Inzelt, 2004). The advantages that these links provide are evident: for example, a direct connection to the economic, social, technological and cultural environment together with feedback is ensured, the university is orienting the graduates towards the organisation it collaborates with, the partner organisations can offer positions for practice for the university students, and the transfer of technology is easier in both directions (Bratianu and Stanciu, 2010).

To calculate this construct, the following three items were considered and assessed with a Likert 5-point scale:

-   Degree to which your University researchers have informal contacts with Business people (phone, email, ...).
-   Degree to which your University researchers have formal contacts with Business people (conferences, exhibitions, workshops, ...).
-   Degree to which your University develops Networking sessions or meetings for academics to meet business people.

Mobility to Industry [IND_MOBILITY]: The recognition of the value of mobility (beyond the local level to the international plane) of students, academics and industrial collaborators in developing and enhancing both Entrepreneurial Universities and UBC, is essential (Davey et al., 2011, Gibb, 2012).

To calculate this construct, the following four items were considered and assessed with a Likert 5-point scale:

- Degree to which your University cooperates with Business in respect to Mobility of students.
- Degree to which your University cooperates with Business in respect to Mobility of academics.
- Degree to which your University has Industry projects as part of training and education (e.g., final year project, PBL).
- Degree to which your University has personnel exchanges with Business.

Consulting [CONSULTING]: Directly selling academic expertise to external organisations to solve practical problems.

To calculate this construct, a single items was considered and assessed with a Likert 5-point scale:

- Degree to which your University gets consulting incomes from Business sector.

Industry Training Courses [I_TRAINING]: The provision of adult education, permanent education and/or continuing education involving the acquisition of skills, knowledge, attitudes and behaviours at all stages of life by HEIs.

To calculate this construct, a single item was considered and assessed with a Likert 5-point scale:

- Degree to which your University cooperates with Business in respect to Lifelong Learning (Industry Training Courses).

Collaborative Research [PR_RESEARCH]: A collaborative research agreement involves multiple partners, often a mixture of private and public sector actors, working together on a particular research project. Each partner contributes an amount of money, skilled talent, and technology to a central group to conduct research.

To calculate this construct, the following three items were considered and assessed with a Likert 5-point scale:

- Degree to which your University develops contract research with Business.
- Degree to which your University raises revenue from industry.
- Degree to which your University develops research project in collaboration with business.

Patents & Licenses [PATENT_LICENSE]: Securing intellectual property rights to discoveries and know-how developed within the university.

To calculate this construct, the following three items were considered and assessed with a Likert 5-point scale:

- Degree to which your University askes for Patent applications.
- Degree to which your University gets incomes from Licenses.
- Degree to which your University researchers use Patenting and Licensing as a Technology Transfer mechanism.

Student Spin-off [SSO]: Students Spin-offs are new companies started by students who are still affiliated with the university.

To calculate this construct, the following four items were considered and assessed with a Likert 5-point scale:

- Degree to which your University creates Students Spin-Off.
- Degree to which your University Students combine their studies with the creation of their own business simultaneously.
- Degree to which your University Students create a spin-off firm on an academic project (PBL, final year project, etc.).
- Degree to which your University Students are involved within an Entrepreneurial Process.

Academic Spin-off [ASO]: Academic spin-offs are new companies that evolve from universities as a result of the technology transfer process; from research to commercialisation of new products or services.

To calculate this construct, the following five items were considered and assessed with a Likert 5-point scale:

- Degree to which your University creates Academic Spin-Off.
- Degree to which your University researchers combine academic job with the creation of their own business simultaneously
- Degree to which your University researchers create to spin-off a company based on existing or past research projects
- Degree to which your University researchers are involved within an Entrepreneurial Process
- Degree to which your University researchers give up their academic job and become entrepreneurs

4.5   SUMMARY

First of all, through this chapter the research design and methodology of the present thesis were developed, establishing the research objectives and the consecutive research hypotheses. Then, from this baseline, the methodology used to test the conceptual model and hypotheses were discussed. In addition, the chapter addressed the key issues related to data collection in the quantitative phases of the study: the unit of analysis, the choice of the survey instrument, and population targeted.

The main objective of the present research work was *"to develop an empirical-institutional analysis of the factors that affects the Entrepreneurial University",* which was composed by three specific objectives. In addition, ten hypotheses were developed to research the main objective of the study (see Table 37).

Table 37 Research hypotheses

SPECIFIC OBJECTIVES	*SUB - OBJECTIVES*	*HYPOTHESES*
To analyse the relationships between external environmental factors, internal organisational factors, entrepreneurship support mechanisms and Entrepreneurial University's results.	To analyse the relationship between external environmental factors and Entrepreneurial University's results	**H1.** External environmental factors influence positively and significantly on Entrepreneurial University's results
	To analyse the relationship between internal organisation factors and Entrepreneurial University's results.	**H2.** Internal organisation factors influence positively and significantly on Entrepreneurial University's results
	To analyse the relationship between entrepreneurship support mechanisms and Entrepreneurial University's results.	**H3.** Entrepreneurship support mechanisms influence positively and significantly on Entrepreneurial University's results
To analyse the impact of each entrepreneurship support mechanisms on Entrepreneurial University's results.	To describe the impact of entrepreneurship support mechanisms on Entrepreneurial University's results.	**H4.** Universities that promote more entrepreneurship support mechanisms obtain higher values on Entrepreneurial University's results than the rest.
		H5. Universities engage with an incubator obtain higher Entrepreneurial University's results than the rest.
		H6. Universities engage with a technology park obtain higher Entrepreneurial University's results than the rest.
	To analyse the impact of entrepreneurship support mechanisms on Hard AEA	**H7.** Universities which obtain higher values on Hard AEA have significantly higher values on some specific entrepreneurship support mechanisms.
	To analyse the impact of entrepreneurship support mechanisms on Soft AEA	**H8.** Universities which obtain higher values on Soft AEA have significantly higher values on some specific entrepreneurship support mechanisms.
	To estimate a predictive model and identify the entrepreneurship support mechanisms which must be influenced in order to evolve a university from its current scenario in Entrepreneurial University's results to a superior one.	A. Using the "Discriminant Analysis" statistical technique. B. Using the "Lineal regression".
To develop a universities' taxonomy depending on Entrepreneurial University's results.		**H9.** Universities that pursue Soft AEA developed different entrepreneurship support mechanisms from the ones that pursue Hard AEA.
		H10. Universities that are above the mean regarding Hard AEA, are the ones that obtain the worse values on Soft-AEA.

Concerning the research methodology, the present research was a quantitative research which an explanatory purpose; due to its overall objective of developing an empirical-institutional analysis of the factors that affects the Entrepreneurial University. Moreover, the research strategy was the survey and the data collection method was an emailed questionnaire. Highlight that the unit of analysis is the university, specifically European universities and the analysis was conducted by different computer programs, such as the SPSS software and the SmartPLS software.

Finally, the measurement scale of each variable (both independent and dependent) was explained in deep.

In the table below (see Table 38), a summary of the research design and methodology is shown.

Table 38 Summary of the research design

Concept	Description of the selection
Purpose	Descriptive and explanatory
Strategy	Survey
Type	Quantitative
Data collection method	Online questionnaire
Data analysis	Using both software, SPSS and SmartPLS
Sample	European universities that are concerned with universities third mission.
Independent variables	INST_CONTEXT, INDUS_CONTEXT, STRATEGY, POLICIES, INDUS_CURRI, INTERNATIONALISATION, E_FUNDS, E_EDUCATION, METHODS, E_CURRI_ACTIVITIES, E_STAFF, MANAG_SUPPORT, ORGANI_DESIGN, INCUBATOR and TECH_PARK
Dependent variables	INFO_DISSEMINATION, NETWORKING, I_TRAINING, IND_MOBILITY CONSULTING, PR_RESEARCH, PATENT_LICENSE, ASO and SSO

Chapter 5
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Data analysis and research results

5.   DATA ANALYSIS AND RESEARCH RESULTS

This chapter deals with data analysis procedures and empirical findings interpretation. Specifically, data analysis is the application of reasoning to understand the gathered data (Zikmund, 2003). The choice of the methods for the statistical analysis depends on the type of question to be answered, the number of variables, and the measurement scale. The type of question that the researcher is attempting to answer is a consideration in the choice of the statistical technique. From this basis, data analysis for this study included reliability analysis (Cronbach's alpha), exploratory factor analysis, descriptive statistics, independent samples *t*-test, analysis of variances (ANOVA), cluster analysis, discriminant function analysis and the multiple linear regression. In order to apply these statistical techniques, the Statistical package for the social sciences (SPSS) version 20.0 for Windows was used. Furthermore, for testing the proposed structural model a variance-based SEM approach was used, specifically, the PLS-SEM) approach. For this analysis, the SmartPLS 2.0M3 software was used.

Thanks to these statistical techniques, the immediate results were translated into integrated and meaningful statistics and findings. The findings were proved to be related to the objectives of the research. The success of this study was assured through both the data analysis and interpretation which were carried out in an orderly manner.

5.1   CONFIRMATION OF VARIABLES' VALIDITY AND RELIABILITY

The measuring instrument seeks to confirm the validity and reliability of the variables under consideration; thus this section was intended to show the procedure followed in reviewing the validity of the data. At the same time a test of normality, was applied in order to identify the variables that do not show normal behaviour and therefore were susceptible to misinterpretation.

After that, both the reliability of the data and validity of the measurement scale were analysed. In order to achieve this goal, an exploratory factor analysis (EFA) and internal consistency tests were conducted. EFA was performed only on scales with more than three items, because EFA may not be appropriate for scales with fewer items (the number of degrees of freedom is not positive).

5.1.1   Normality test

Theoretically, statistical analysis can be categorised into two board groups which are parametric statistics and non-parametric statistics (Chantasorn, 2011).

However, there is a limitation of a requirement for a normal distribution of random variables (Higgins, 2004); since a normal distribution is vital for this kind of analysis. In that case, any researcher that wishes to employ this statistical process must firstly verify the existence of a normal distribution to ensure that parametric statistics can be carried out.

There are several ways to test the normal distribution, ranging by degree of easiness, from graphical to statistical tests (SPSS, 1983). Usually, researchers test the normal distribution first through visual inspection (histogram and normal probability plot). However, other numerous statistical tests have been also developed such as Anderson & Darling (Anderson and Darling, 1954) or Kolmogorov – Smirnov (Kolmogorov, 1933) or Shapiro – Wilk (Shapiro and Wilk, 1964), all of which are widely recognised among researchers (Chantasorn, 2011). Indeed, for the present research analysis the univariate normality was tested through inspecting the Skeweness and Kurtosis statistics as shown in Table 39, Table 40 and Table 41. All the values of Kurtosis and Skeweness statistics were within the conventional range of ±1,96 (Ghasemi and Zahediasl, 2012). Thus, all manifest variables were reasonably normally distributed.

Table 39 Skeweness and Kurtosis results at the item level

	N	Minimum	Maximum	Mean	Std. Dev.	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
I_Inst1	69	2,00	5,00	3,5507	,86664	-,091	,289	-,594	,570
I_Inst2	69	2,00	5,00	3,1177	,96298	,367	,289	-,885	,570
I_Inst3	69	1,00	5,00	3,0870	,98128	-,178	,289	-,731	,570
I_Inst4	69	1,00	4,00	2,6087	,84396	,403	,289	-,797	,570
I_Indus1	69	1,00	5,00	3,1641	,94864	,188	,289	-,556	,570
I_Indus2	69	1,00	5,00	3,1177	,99306	,313	,289	-,678	,570
I_Indus3	69	1,00	5,00	3,1912	1,00378	,228	,289	-,728	,570
I_Indus4	69	1,00	5,00	3,2354	1,01630	,022	,289	-,592	,570
I_Indus5	69	1,00	5,00	2,6867	,84382	,519	,289	,399	,570
Strag1	69	1,00	5,00	3,1594	1,07953	,251	,289	-,776	,570
Strag2	69	1,00	5,00	3,4925	1,04843	-,492	,289	-,212	,570
Strag3	69	1,00	5,00	3,0870	1,14711	,006	,289	-,895	,570
Strag4	69	1,00	5,00	3,7101	1,13890	-,509	,289	-,698	,570
Plcs1	69	1,00	5,00	3,4412	1,08982	-,336	,289	-,816	,570
Plcs2	69	1,00	5,00	3,2090	1,09191	-,087	,289	-,868	,570
Plcs3	69	1,00	5,00	3,7354	1,00904	-,586	,289	-,310	,570
IndCurri1	69	1,00	5,00	2,8986	1,16499	,260	,289	-,710	,570
IndCurri2	69	1,00	5,00	2,9710	,72702	,281	,289	1,040	,570
IndCurri3	69	1,00	5,00	2,9117	,85294	,174	,289	1,300	,570
IndCurri4	69	1,00	5,00	2,8261	,78509	-,243	,289	1,722	,570
IndCurri5	69	1,00	5,00	2,7681	1,07300	,703	,289	-,208	,570
IndCurri6	69	1,00	5,00	3,4348	1,06382	-,126	,289	-,958	,570
Inter1	69	2,00	5,00	3,6812	,88272	-,244	,289	-,575	,570
Inter2	69	1,00	5,00	3,6522	,92077	-,290	,289	-,135	,570
Inter3	69	1,00	5,00	2,8938	1,11314	,087	,289	-,515	,570
Inter4	69	1,00	5,00	2,9104	,99604	,279	,289	-,603	,570
EPrcss1	69	1,00	5,00	3,1304	,99872	-,178	,289	-,293	,570
EPrcss2	69	1,00	5,00	3,4348	,91520	-,039	,289	-,244	,570
EPrcss3	69	1,00	5,00	3,4854	1,13102	-,496	,289	-,463	,570
EPrcss4	69	1,00	5,00	3,3043	1,21636	-,259	,289	-,818	,570
EFunds1	69	1,00	5,00	2,7014	,98541	,458	,289	-,297	,570
EFunds2	69	1,00	5,00	2,6323	1,01321	,457	,289	-,283	,570
EFunds3	69	1,00	5,00	1,9412	1,09655	1,154	,289	,551	,570
EEducation1	69	1,00	5,00	2,9854	1,19426	,456	,289	-1,022	,570
EEducation2	69	1,00	5,00	3,0290	,96970	-,059	,289	-,229	,570
EEducation3	69	1,00	5,00	3,0294	,96970	-,061	,289	-,229	,570
Methods1	69	1,00	5,00	2,7826	,96816	,255	,289	-,247	570
Methods2	69	1,00	5,00	3,0745	1,11558	,110	,289	-,822	570
Methods3	69	1,00	5,00	3,2500	,97581	,055	,289	-,283	570
EStaff1	69	1,00	5,00	2,8116	1,19158	,054	,289	-,947	570

Table 40 Skeweness and Kurtosis results at the item level (continuation)

	N	Minimum	Maximum	Mean	Std. Dev.	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
EStaff2	69	1,00	5,00	2,2174	1,06922	,664	,289	-,185	,570
EStaff3	69	1,00	5,00	2,2464	1,11679	,797	,289	,184	,570
Dissemin.1	69	1,00	4,00	2,2754	,56579	,968	,289	1,244	,570
Dissemin.2	69	1,00	5,00	3,0870	,98128	,399	,289	,300	,570
Dissemin.3	69	1,00	5,00	3,2652	,94897	,071	,289	-,056	,570
Ntwrk1	69	2,00	5,00	3,7391	,74067	-,879	,289	,804	,570
Ntwrk2	69	1,00	4,00	2,7246	,59121	-,727	,289	,920	,570
Ntwrk3	69	1,00	5,00	3,3043	1,00447	-,203	,289	-,221	,570
I_Trainig	69	1,00	5,00	3,0435	,86492	,196	,289	,335	,570
IndMoblt1	69	1,00	4,00	2,2464	,71550	1,085	,289	1,289	,570
IndMoblt2	69	1,00	4,00	2,1159	,75802	1,054	,289	1,474	,570
IndMoblt3	69	1,00	5,00	3,2464	,92999	,386	,289	-,107	,570
IndMoblt4	69	1,00	5,00	3,2794	1,09606	-,241	,289	-,602	,570
Consulting	69	1,00	5,00	3,2319	,80704	,413	,289	,809	,570
Pr_Resear.1	69	1,00	5,00	3,5290	,81747	-,262	,289	1,080	,570
Pr_Resear.2	69	1,00	5,00	3,0725	1,11565	-,016	,289	-1,035	,570
Pr_Resear.3	69	1,00	5,00	3,2754	,95308	,044	,289	-,106	,570
Patent_Lic.1	69	1,00	4,00	2,0000	,56880	,494	,289	2,081	,570
Patent_Lic.2	69	1,00	5,00	2,8971	,80695	,021	,289	,745	,570
Patent_Lic.3	69	1,00	5,00	2,8116	,71281	-,460	,289	1,919	,570
ASO1	69	2,00	4,00	2,9275	,52353	-,097	,289	,742	,570
ASO2	69	1,00	4,00	2,3768	,74954	,544	,289	,083	,570
ASO3	69	1,00	5,00	2,1449	,92792	,954	,289	1,270	,570
ASO4	69	1,00	5,00	2,8261	,74669	,515	,289	,940	,570
ASO5	69	1,00	5,00	2,4638	,93273	,052	,289	,200	,570
SSO1	69	1,00	5,00	2,9275	,84573	,140	,289	,665	,570
SSO2	69	1,00	4,00	2,4348	,77608	,613	,289	-,117	,570
SSO3	69	1,00	4,00	2,7246	,74526	-,160	,289	-,189	,570
SSO4	69	1,00	5,00	2,8261	,70620	,518	,289	1,653	,570
GovSpp1	69	1,00	5,00	3,3623	,96970	-,096	,289	-,633	,570
GovSpp2	69	1,00	5,00	3,4493	1,02234	-,412	,289	-,486	,570
GovSpp3	69	1,00	5,00	2,9852	,96242	,030	,289	-,609	,570
GovSpp4	69	1,00	5,00	2,9559	,91449	,208	,289	-,423	,570
OrgDsgn1	69	1,00	5,00	3,5507	,93205	-,433	,289	-,219	,570
OrgDsgn2	69	1,00	5,00	2,7246	,99829	,311	,289	-,351	,570
OrgDsgn3	69	1,00	5,00	2,9403	,99824	-,059	,289	-,522	,570
OrgDsgn4	69	1,00	5,00	2,9559	1,09052	,230	,289	-,553	,570

Table 41 Skeweness and Kurtosis results at the construct level

	N	Minimum	Maximum	Mean	Std. Dev.	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
INST_CONTEXT	69	1,50	4,80	3,1072	,73491	,076	,289	-,372	,570
INDUS_CONTEXT	69	1,40	4,80	3,0797	,78151	,264	,289	-,351	,570
STRATEGY	69	1,30	5,00	3,3826	,88649	-,122	,289	-,442	,570
POLICIES	69	1,00	5,00	3,4616	,96867	-,446	,289	-,620	,570
INDUS_CURRI	69	1,40	4,80	2,9968	,75443	,234	,289	-,402	,570
INTERNATIONA.	69	1,25	5,00	3,2843	,83722	,190	,289	-,355	,570
E_CURRI_ACTIVIT.	69	1,00	5,00	3,3387	,92678	-,310	,289	-,176	,570
E_FUNDS	69	1,00	5,00	2,4254	,89540	,978	,289	,965	,570
E_EDUCATION	69	1,00	5,00	3,0149	,90754	,410	,289	-,400	,570
METHODS	69	1,00	5,00	3,0361	,82034	-,025	,289	,304	,570
E_STAFF	69	1,00	5,00	2,4248	1,00179	,538	,289	-,159	,570
INFO_DISSEMINA.	69	1,00	4,33	2,8761	,62047	,211	,289	,746	,570
NETWORKING	69	1,33	4,33	3,2532	,62159	-,732	,289	,350	,570
I_TRAINING	69	1,00	5,00	3,0435	,86492	,196	,289	,335	,570
IND_MOBILITY	69	1,00	4,33	2,5343	,62410	,801	,289	1,602	,570
CONSULTING	69	1,00	5,00	3,2319	,80704	,413	,289	,809	,570
PR_RESEARCH	69	1,67	5,00	3,2919	,70043	,324	,289	-,075	,570
PATENT_LICENSE	69	1,00	4,00	2,5707	,59232	-,396	,289	,857	,570
ASO	69	1,40	4,20	2,5478	,56532	,853	,289	1,386	,570
SSO	69	1,25	4,25	2,7283	,61198	,358	,289	,768	,570
MANAG_SUPPORT	69	1,00	5,00	3,1883	,79326	-,131	,289	-,065	,570
ORGANI_DESIGN	69	1,00	4,75	3,0430	,75977	,132	,289	-,013	,570

5.1.2 Validity analysis

As Ritchie and Lewis (2003) indicated, the validity of research is conceived as the precision or correctness of the research finding. Thereby, validity is concerned with two main issues: content validity and construct validation.

Content validity is established by showing that the tested items are a sample of a universe in which the investigator is interested. Content validity is ordinarily to be established deductively, by defining a universe of items and sampling systematically within this universe to establish the test (Cronbach and Meehl, 1955). Thereby, the content validity of the constructs used in this study was assessed by six different experts during the first stage of the pretesting of the questionnaire. The first stage of the pretesting of the draft survey involved a review by a group of experts from different positions and profiles, such as deans, TTO directors, academic coordinators and entrepreneurship teachers.

Construct validation is involved whenever a test is interpreted as a measure of some attribute or quality which is not "operationally defined" (Cronbach and Meehl, 1955). Furthermore, for the construct validation two subcategories or subtypes have to be considered: convergent and discriminant validity (Trochim, 2003). Indeed, construct convergent validity and discriminant validity were assessed using EFA (Floyd and Widaman, 1995, Hof, 2012). Construct convergent validity assesses the degree to which two measures of the same concept are correlated (Hair et al., 1998). Discriminant validity is the degree to which two conceptually similar concepts are distinct (Hair et al., 1998).

EFA was performed, using the maximum likelihood extraction method and Direct Oblimin rotation (which is an oblique rotation) with Kaiser Normalization. Oblique rotation was selected since (i) the theory behind the measurement models does not assume that the factors are orthogonal, but (ii) that they covariate due to a higher-order factor (Floyd and Widaman, 1995), and (iii) the oblique rotations allow correlated factors instead of maintaining independence between the rotated factors (Hair et al., 1998). Given a set of data, it was important to determine whether the data was appropriate for factor analysis (Craig and Douglas, 2005). Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (onwards, KMO) test were used to determine whether data was appropriated for factor analysis. KMO values of 0,80 or above are meritorious, 0,70 or above are middling, 0,60 or above are mediocre, 0,50 or above are miserable, and below 0,50 are unacceptable (Hair et al., 1998).

Furthermore, as just mentioned, the recommended minimum value for KMO measured is 0,50 (Pett et al., 2003); thus, as all the scales had a KMO value higher than 0,50 and the Bartlett's Test of Sphericity was significant for all of them by 0,000; sampling adequacy was fulfilled (see Table 42, Table 43, Table 44, Table 45 and Table 46).

Table 42 Independent variables EFA results

ITEMS	FACTOR LOADINGS
INSTITUTIONAL CONTEXT (INST_CONTEXT)	
I_Inst1	0,730
I_Inst2	0,800
I_Inst3	0,862
I_Inst4	0,824
Bartlett's test of sphericity – chi-square	*92,872*
Bartlett's test of sphericity – degrees of freedom	*6*
Bartlett's test of sphericity – sig.	*0,000*
Kaiser-Meyer-Olkin measure of sampling adequacy	*0,787*
Variance explained	*%64,865*
INDUSTRIAL CONTEXT (INDUS_CONTEXT)	
I_Indus1	0,761
I_Indus2	0,721
I_Indus3	0,863
I_Indus4	0,873
I_Indus5	0,841
Bartlett's test of sphericity – chi-square	*180,969*
Bartlett's test of sphericity – degrees of freedom	*10*
Bartlett's test of sphericity – sig.	*0,000*
Kaiser-Meyer-Olkin measure of sampling adequacy	*0,805*
Variance explained	*%66,247*
STRATEGY (STRATEGY)	
Strag1	0,806
Strag2	0,703
Strag3	0,905
Strag4	0,802
Bartlett's test of sphericity – chi-square	*116,550*
Bartlett's test of sphericity – degrees of freedom	*6*
Bartlett's test of sphericity – sig.	*0,000*
Kaiser-Meyer-Olkin measure of sampling adequacy	*0,696*
Variance explained	*%65,129*
MANAGEMENT SUPPORT (MANAG_SUPPORT)	
GovSpp1	0,835
GovSpp2	0,870
GovSpp3	0,788
GovSpp4	0,782
Bartlett's test of sphericity – chi-square	*105,723*
Bartlett's test of sphericity – degrees of freedom	*6*
Bartlett's test of sphericity – sig.	*0,000*
Kaiser-Meyer-Olkin measure of sampling adequacy	*0,783*
Variance explained	*%67,163*
ORGANISATIONAL DESIGN (ORGANI_DESIGN)	
OrgDsgn1	0,708
OrgDsgn2	0,796
OrgDsgn3	0,749
OrgDsgn4	0,767
Bartlett's test of sphericity – chi-square	*59,175*
Bartlett's test of sphericity – degrees of freedom	*6*
Bartlett's test of sphericity – sig.	*0,000*
Kaiser-Meyer-Olkin measure of sampling adequacy	*0,739*
Variance explained	*%57,102*
POLICIES (POLICIES)	
Plcs1	0,936
Plcs2	0,897
Plcs3	0,897
Bartlett's test of sphericity – chi-square	*123,977*
Bartlett's test of sphericity – degrees of freedom	*3*
Bartlett's test of sphericity – sig.	*0,000*
Kaiser-Meyer-Olkin measure of sampling adequacy	*0,730*
Variance explained	*%82,866*

Table 43 Independent variables EFA results (continuation I)

ITEMS	FACTOR LOADINGS
INDUSTRY IN CURRICULUM D&D (INDUS_CURRI)	
IndCurri1	0,776
IndCurri2	0,735
IndCurri3	0,760
IndCurri5	0,787
IndCurri6	0,780
Bartlett's test of sphericity – chi-square	*123,977*
Bartlett's test of sphericity – degrees of freedom	*3*
Bartlett's test of sphericity – sig.	*0,000*
Kaiser-Meyer-Olkin measure of sampling adequacy	*0,730*
Variance explained	*%58,947*
INTERNATIONALISATION (INTERNATIONALISATION)	
Inter1	0,828
Inter2	0,854
Inter3	0,861
Inter4	0,875
Bartlett's test of sphericity – chi-square	*135,369*
Bartlett's test of sphericity – degrees of freedom	*6*
Bartlett's test of sphericity – sig.	*0,000*
Kaiser-Meyer-Olkin measure of sampling adequacy	*0,821*
Variance explained	*%73,064*
FUNDS FOR ENTREPRENEURSHIP (E_FUND)	
EFunds1	0,865
EFunds2	0,906
EFunds3	0,834
Bartlett's test of sphericity – chi-square	*82,573*
Bartlett's test of sphericity – degrees of freedom	*3*
Bartlett's test of sphericity – sig.	*0,000*
Kaiser-Meyer-Olkin measure of sampling adequacy	*0,698*
Variance explained	*%75,469*
ENTREPRENEURSHIP EDUCATION (E_EDUCATION)	
EEducation1	0,693
EEducation2	0,966
EEducation3	0,966
Bartlett's test of sphericity – chi-square	*757,690*
Bartlett's test of sphericity – degrees of freedom	*3*
Bartlett's test of sphericity – sig.	*0,000*
Kaiser-Meyer-Olkin measure of sampling adequacy	*0,595*
Variance explained	*%78,214*
TEACHING ACTIVE METHODOLOGIES (METHODS)	
Methods1	0,734
Methods2	0,862
Methods3	0,809
Bartlett's test of sphericity – chi-square	*43,846*
Bartlett's test of sphericity – degrees of freedom	*3*
Bartlett's test of sphericity – sig.	*0,000*
Kaiser-Meyer-Olkin measure of sampling adequacy	*0,640*
Variance explained	*%64,554*
UNIVERSITY SUPPORT THROUGH THE WHOLE ENTREPRENEURSHIP PROCESS (E_CURRI_ACTIVITIES)	
EPrcss1	0,837
EPrcss2	0,827
EPrcss3	0,878
EPrcss4	0,920
Bartlett's test of sphericity – chi-square	*168,543*
Bartlett's test of sphericity – degrees of freedom	*6*
Bartlett's test of sphericity – sig.	*0,000*
Kaiser-Meyer-Olkin measure of sampling adequacy	*0,774*
Variance explained	*%75,083*

Table 44 Independent variables EFA results (continuation II)

ITEMS	FACTOR LOADINGS
STAFF DEVELOPMENT IN ENTREPRENEURSHIP (E_STAFF)	
EStaff1	0,804
EStaff2	0,942
EStaff3	0,927
Bartlett's test of sphericity – chi-square	*130,311*
Bartlett's test of sphericity – degrees of freedom	*3*
Bartlett's test of sphericity – sig.	*0,000*
Kaiser-Meyer-Olkin measure of sampling adequacy	*0,664*
Variance explained	*%79,782*

Table 45 Dependent variables EFA results

ITEMS	FACTOR LOADINGS
INFORMATION DISSEMINATION (I_DISSEMINATION)	
Dissemination1	0,809
Dissemination2	0,882
Dissemination3	0,503
Bartlett's test of sphericity – chi-square	*31,668*
Bartlett's test of sphericity – degrees of freedom	*3*
Bartlett's test of sphericity – sig.	*0,000*
Kaiser-Meyer-Olkin measure of sampling adequacy	*0,511*
Variance explained	*%56,140*
NETWORKING (NETWORKING)	
Ntwrk1	0,903
Ntwrk2	0,831
Ntwrk3	0,663
Bartlett's test of sphericity – chi-square	*54,648*
Bartlett's test of sphericity – degrees of freedom	*3*
Bartlett's test of sphericity – sig.	*0,000*
Kaiser-Meyer-Olkin measure of sampling adequacy	*0,568*
Variance explained	*%64,798*
INDUSTRY MOBILITY (IND_MOBILITY)	
IndMoblt1	,881
IndMoblt2	,715
IndMoblt3	,746
Bartlett's test of sphericity – chi-square	*39,614*
Bartlett's test of sphericity – degrees of freedom	*3*
Bartlett's test of sphericity – sig.	*0,000*
Kaiser-Meyer-Olkin measure of sampling adequacy	*0,566*
Variance explained	*%61,409*
COLLABORATIVE RESEARCH (PR_RESEARCH)	
Pr_Research1	0,806
Pr_Research2	0,836
Pr_Research3	0,502
Bartlett's test of sphericity – chi-square	*21,464*
Bartlett's test of sphericity – degrees of freedom	*3*
Bartlett's test of sphericity – sig.	*0,000*
Kaiser-Meyer-Olkin measure of sampling adequacy	*0,5548*
Variance explained	*%53,377*
PATENT&LICENSES (PATENT_LICENSE)	
Patent_License1	0,767
Patent_License2	0,860
Patent_License3	0,901
Bartlett's test of sphericity – chi-square	*69,803*
Bartlett's test of sphericity – degrees of freedom	*3*
Bartlett's test of sphericity – sig.	*0,000*
Kaiser-Meyer-Olkin measure of sampling adequacy	*0,655*
Variance explained	*%71,275*

Table 46 Dependent variables EFA results (continuation)

ITEMS	FACTOR LOADINGS
ACADEMIC SPIN-OFF (ASO)	
ASO1	0,599
ASO2	0,777
ASO3	0,712
ASO4	0,753
ASO5	0,752
Bartlett's test of sphericity – chi-square	*83,450*
Bartlett's test of sphericity – degrees of freedom	*10*
Bartlett's test of sphericity – sig.	*0,000*
Kaiser-Meyer-Olkin measure of sampling adequacy	*0,731*
Variance explained	*%52,059*
STUDENT SPIN-OFF (SSO)	
SSO1	0,785
SSO2	0,719
SSO3	0,818
SSO4	0,868
Bartlett's test of sphericity – chi-square	*94,041*
Bartlett's test of sphericity – degrees of freedom	*6*
Bartlett's test of sphericity – sig.	*0,000*
Kaiser-Meyer-Olkin measure of sampling adequacy	*0,746*
Variance explained	*%63,940*

5.1.3 Reliability analysis

According to the classical test theory, scale reliability strictly refers to the proportion of variance attributable to the true score of latent variables (DeVellis, 2011). Indeed, scale reliability could generally be classified into three types: (i) the internal consistency reliability which can be regarded as the homogeneity of items within a scale; (ii) the test-retest reliability which is concerned with the stability of item responses over time; and, (iii) the alternative-form reliability which refers to the extent to which two different statements can be used to measure the same construct at two different times (Asaad, 2011).

Through the present research, scale reliability was referred as the internal consistency reliability; since the internal consistency of a scale is an important measurement property as it implies items of the scale (Netemeyer et al., 2003). Following Churchill J (1979)'s recommendation, the internal consistency of scales was measured by their Cronbach's alpha coefficient (Cronbach, 1951). Theoretically, Cronbach's alpha coefficient is concerned with the degree of interrelatedness among a set of items designed to measure a single construct (Netemeyer et al., 2003). Thus, the coefficient alpha and item-to-total correlation for each provisional construct were assessed. The statistical criteria for item retention were (i) a corrected item-to-item correlation above 0,35 (Bearden et al., 2001) and (ii) a coefficient alpha above 0,70 (Churchill J, 1979) (see Table 47).

Table 47 Reliability scale according to Cronbach's Alpha (Darren and Mallery, 2003)

Coefficient Cronbach's Alpha	Scale Reliability
α >= 0,90	Excellent
0,70 <= α > 0,90	Good
0,60 <= α > 0,70	Acceptable
0,50 <= α > 0,60	Poor
α < 0,50	Unacceptable

Moreover, for scales with few items a lower coefficient could be good (Nunnally, 1978, Hull and Nie, 1981). The values of Cronbach's alpha obtained for each variable are shown in Table 48. In this case, the values of consistency showed were the final values; this means that some items of specific variables which distort the reliability of the scale were removed.

Table 48 Cronbach's Alpha for all analysed variables

	VARIABLES	CRONBACH'S ALPHA	ITEMS
INDEPENDENT	INST_CONTEXT	0,818	I_Inst1, I_Inst2, I_Inst3, I_Inst4
	INDUS_CONTEXT	0,870	I_Indus1, I_Indus2, I_Indus3, I_Indus4, I_Indus5
	STRATEGY	0,820	Strag1, Strag2, Strag3, Strag4
	POLICIES	0,896	Plcs1, Plcs2, Plcs3
	MANAG_SUPPORT	0,837	GovSpp1, GovSpp2, GovSpp3, GovSpp4
	ORGANI_DESIGN	0,749	OrgDsgn1, OrgDsgn2, OrgDsgn3, OrgDsgn4
	INDUS_CURRI	0,820	IndCurri1, IndCurri2, IndCurri3, IndCurri5, IndCurri6
	INTERNATIONALISATION	0,875	Inter1, Inter2, Inter3, Inter4
	E_CURRI_ACTIVITIES	0,888	EPrcss1, EPrcss2, EPrcss3, EPrcss4
	E_FUNDS	0,835	EFunds1, EFunds2, EFunds3
	E_EDUCATION	0,832	EEducation1, EEducation2, EEducation3
	METHODS	0,725	Methods1, Methods2, Methods3
	E_STAFF	0,867	EStaff1, EStaff2, EStaff3
DEPENDENT	INFO_DISSEMINATION	0,556	Dissemination1, Dissemination2, Dissemination3
	NETWORKING	0,678	Ntwrk1, Ntwrk2, Ntwrk3
	IND_MOBILITY	0,665	IndMoblt1, IndMoblt2, IndMoblt3
	PR_RESEARCH	0,540	Pr_Research1, Pr_Research2, Pr_Research3
	PATENT_LICENSE	0,793	Patent_License1, Patent_License2, Patent_License3
	ASO	0,761	ASO1, ASO2, ASO3, ASO4, ASO5
	SSO	0,806	SSO1, SSO2, SSO3, SSO4

As it is shown in Table 48 there were missing some variables that were collected as study variables, since these variables were composed of a single item. The following variables were in this situation: INCUBATOR and TECH_PARK regarding the independent variables and I_TRAINING and CONSULTING regarding the dependent variables.

The coefficients obtained for the different variables of the study were very acceptable, since (except for three cases) all values were above 0,70 and about 0,80 in many cases. Thus, the internal consistency of measured variables was very acceptable. As a result, for calculating the value of the variables that were used in this study it was considered appropriate to proceed to the average of the items that compose the variable (Ganzarain et al., 2006, Zabaleta, 2008, Errasti, 2009).

In addition, an EFA was developed within the dependent variables in order to confirm empirically if the classification defined for academic entrepreneurship activities (see Section 2.4), between Soft AEA and Hard AEA, exist. In the table below (see Table 49), the classification between Soft AEA and Hard AEA is shown; which confirmed the classification.

Table 49 EAF analysis for Hard AEA and Soft AEA

ITEMS	FACTOR LOADINGS	
	COMPONENT 1	COMPONENT 2
SOFT ACADEMIC ENTREPRENEURSHIP ACTIVITIES (α = 0,827)		
INFO_DISSEMINATION		0,676
NETWORKING		0,533
I_TRAINING		0,780
IND_MOBILITY		0,521
CONSULTING		0,741
PR_RESEARCH		0,695
HARD ACADEMIC ENTREPRENEURSHIP ACTIVITIES (α = 0,785)		
PATENT_LICENSE	0,710	
ASO	0,820	
SSO	0,842	
Bartlett's test of sphericity – chi-square	*292,404*	
Bartlett's test of sphericity – degrees of freedom	*36*	
Bartlett's test of sphericity – sig.	*0,000*	
Kaiser-Meyer-Olkin measure of sampling adequacy	*0,769*	
Variance explained	*%61,988*	

5.2   ANALYSIS OF THE SAMPLE

This section analyses the whole sample of the present research, mainly based on the values obtained on the independent and dependent variables. Furthermore, as a number of papers have shown that the Entrepreneurial University's results are influenced by universities' intrinsic characteristics, including the geographical location (e.g. Klofsten and Jones-Evans (2000), Lockett et al. (2003), Shane (2004a) and Bratianu and Stanciu (2010)), the ownership status (e.g. Adams and Griliches (1998), Lach and Schankerman (2008), Belenzon and Schankerman (2009) and Closs et al. (2012)) and the possession of an engineering faculty (e.g. Baldini et al. (2007) and Caldera and Debande (2010)), this three variables were used in order to do the sample analysis. Thereby, a descriptive analysis and its consecutive contrast were developed for each of these variables.

First of all, the study used descriptive statistics as a means to represent the data collected. Antonius (2002) describes descriptive statistics as aiming at summarising large quantities of data by few numbers, in a way that highlights the most important numerical features of the data. Thus, in this first statistical analysis the basic features of the variables used within the study are described. The sample was composed of a total of sixty-nine European universities that were involved into the path towards the Entrepreneurial University (see Section 4.3.3 for details regarding the research sample).

Getting into detail, the graphs below (see Graph 1) shows the means of the independent variables grouping in external, internal and support variables. In relation to external variables, it worth highlighting the small difference between INST_CONTEXT AND INDUS_CONTEXT; the mean of both variables was around 3,1. As for internal variables, there were higher differences between STRATEGY and

ORGANI_DESIGN, since the results shown that universities implemented more entrepreneurial strategies than building a contemporary organisational design.
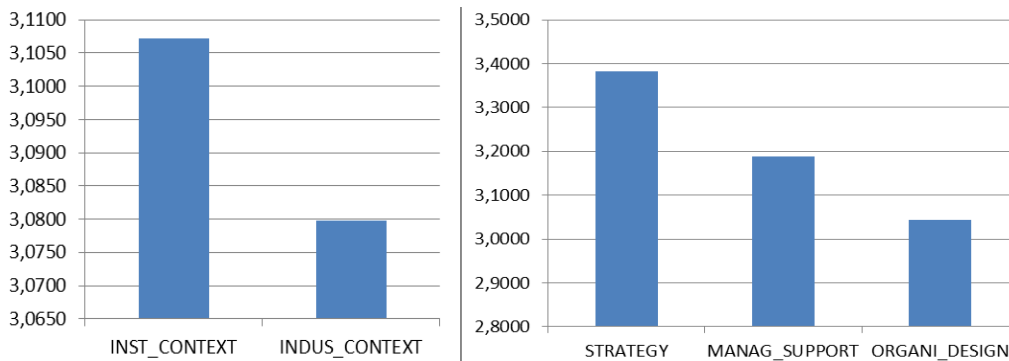
Graph 1 External, strategic and internal values of sample universities

Regarding entrepreneurship support mechanisms (see Graph 2), there were two variables which obtained a lower value than the rest, that were E_FUNDS and E_STAFF. This showed that nowadays universities are not providing too much funds neither to their students, nor to their researchers to boost them into the entrepreneurship path. Furthermore, they did not invest too much training their researchers in entrepreneurial skills and education. Moreover, the variable with the highest value was POLICIES, the mean was indicated as 3,46 on a scale of 5,0, which shown that the majority of the respondent universities stated the path towards the Entrepreneurial University establishing policies regarding technology transfer, university business cooperation and new firms creation.
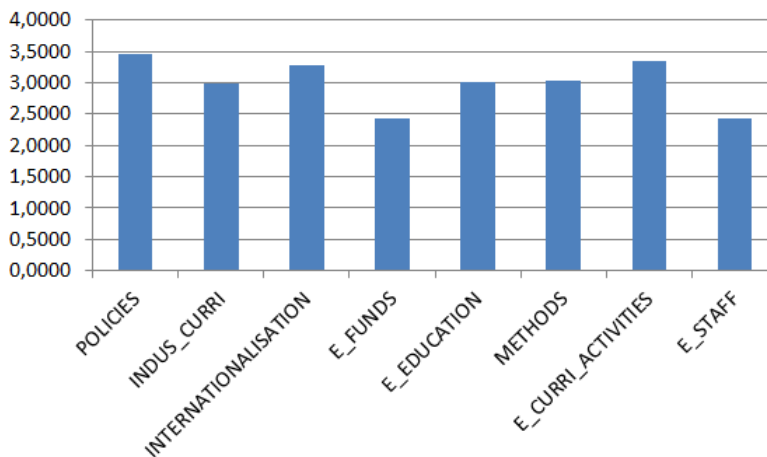
Graph 2 Entrepreneurship support mechanisms' values of sample universities

In Graph 3 Entrepreneurial University's results are represented; figuring out that IND_MOBILITY, PATENT_LICENSE and ASO were the ones that obtained lower values. Concretely, the mean for these variables was around 2,5 on a scale of 5,0. On the other hand, the variables which achieved higher values are NETWORKING and CONSULTING, around 3,2 on a scale of 5,0.
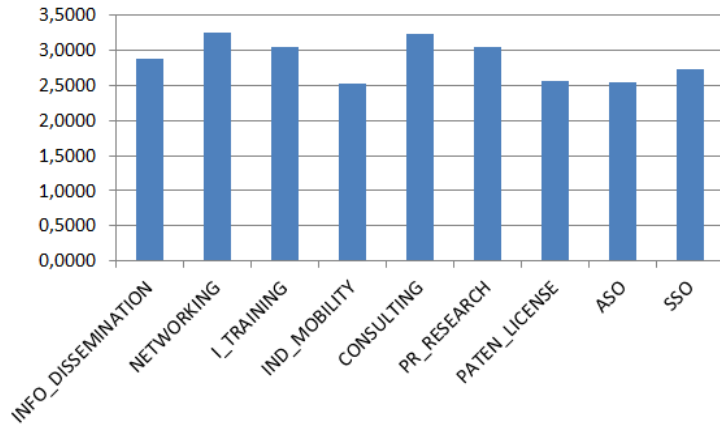
Graph 3 Entrepreneurial University's results of sample universities

Finally, related to universities' intrinsic characteristics, three more interesting variables were measured in order to analyse their influence within the Entrepreneurial University: the geographical location, the ownership status and the possession of an engineering faculty.

As it is shown below (see Graph 4), the majority of universities which replied the questionnaire were public universities with at least one engineering faculty. Furthermore, more than the half of universities had their own or affiliated incubator and/or technology park. Moreover, a higher percentage of universities were from Southern Europe; indeed the majority were from Spain, due to the geographical proximity. In the next pages, an indeed analysis of these four variables is done.
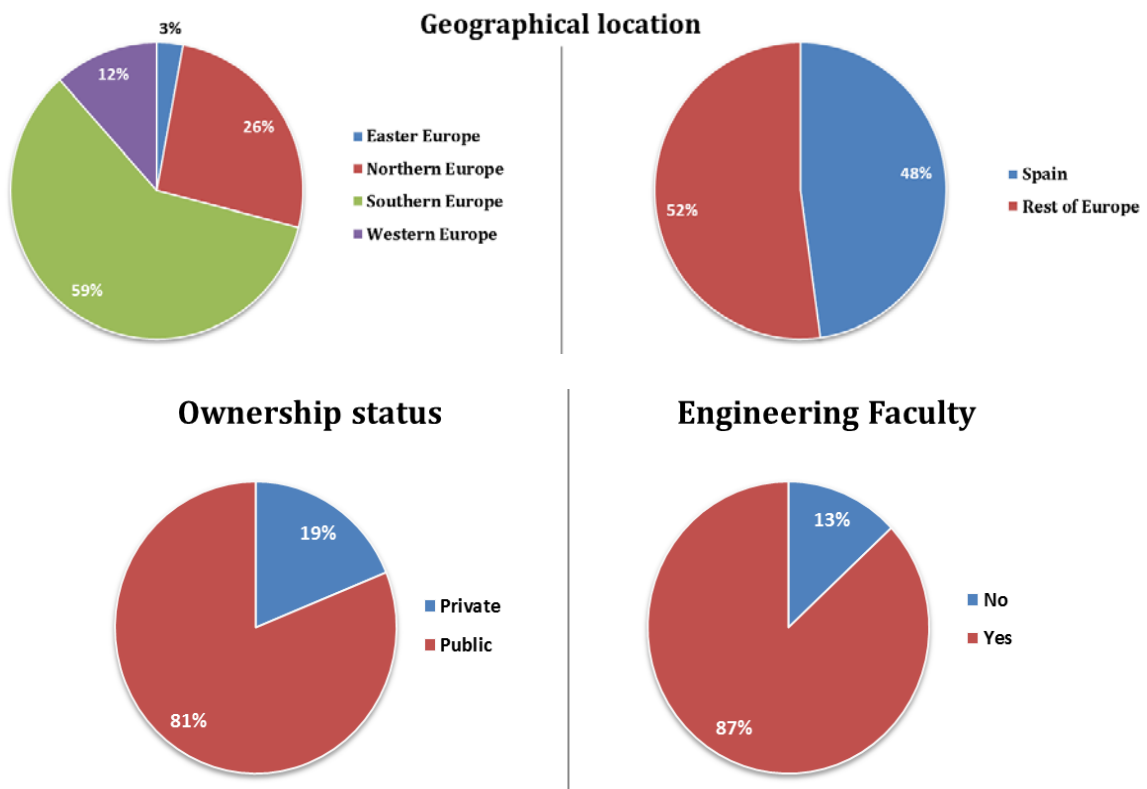
Graph 4 Sample universities' intrinsic characteristics

5.2.1   Geographical location

Based on the idea that Entrepreneurial Universities are geographically dependent (Bratianu and Stanciu, 2010), since universities developed differently in different countries, various authors made clear that some countries like England or Sweden have more Entrepreneurial Universities (Klofsten and Jones-Evans, 2000, Lockett et al., 2003, Shane, 2004a).

Thereby, a geographical classification of respondent universities was done, in order to explore if the geographical location is an important factor. The classification was done following the "Standard Country and Area Codes Classifications" defined by the United Nations Statistic Division (see Table 50). The analysis of this grouping is interesting, since the Entrepreneurial University vary by region and country, reflecting differences in the way both the industry and academia have developed over this past century (Etzkowitz et al., 2000). As an example, the Entrepreneurial University phenomenon is more evident in some European countries like England (Lockett et al., 2003, Shane, 2004) or Sweden (Klofsten and Jones-Evans, 2000); however, most of European countries (including Spain) patents and research contracts prevail as the traditional via to transfer the research results to industry (Siegel et al., 2000).

Table 50 Universities sample breakdown regarding geographical location

European sub-regions	State	Nº of universities	% of the sample
Easter Europe	Poland	2	2,89
Western Europe	Austria France Germany Netherlands Switzerland	3 1 1 2 1	11,59
Southern Europe	Bosnia and Herzegovina Croatia Greece Italy Portugal Slovenia Spain	1 1 2 1 2 2 33	60,87
Northern Europe	Denmark Finland Ireland Latvia Norway Sweden United Kingdom of Great Britain and Northern Ireland	1 3 2 1 3 1 6	24,64
Total		69	100

According to the four sub-regions established in the previous sections, in the following two graphs (see Graph 5 and Graph 6) the means of each group regarding entrepreneurship support mechanisms and Entrepreneurial University's results are shown.
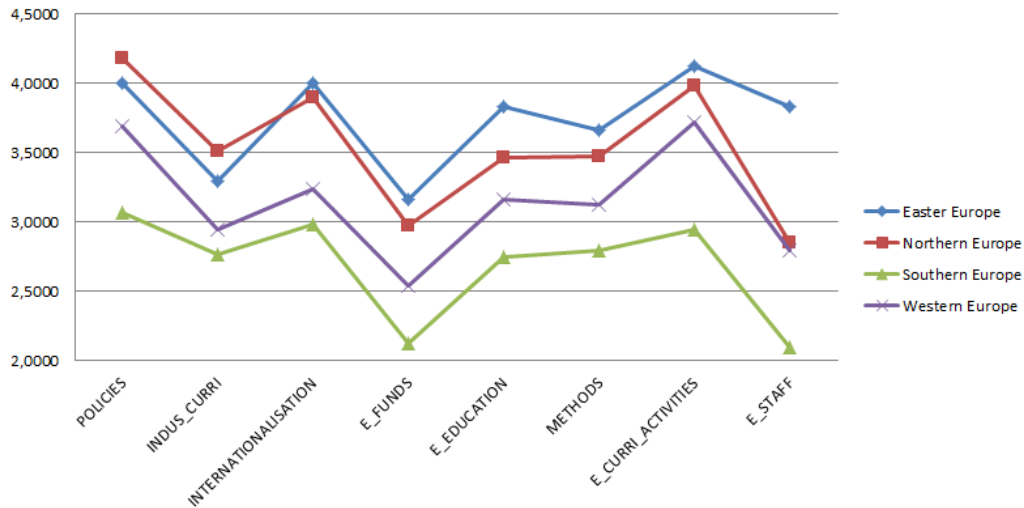
Graph 5 Entrepreneurship support mechanisms regarding geographical location
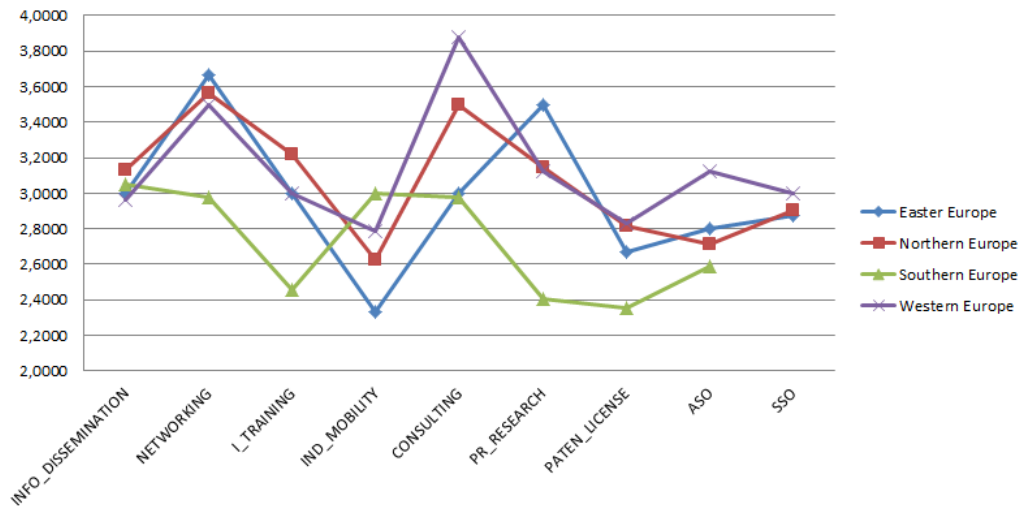
Graph 6 Entrepreneurial University's results regarding geographical location

In terms of entrepreneurship support mechanisms, universities from Southern Europe obtained the worst values and accordingly, they were the universities that obtain the worst values on all Entrepreneurial University's results. On the other hand, universities from Western Europe were the second worst universities in entrepreneurship support mechanisms' promotion; however, they obtained better results in almost all Entrepreneurial University's results than the rest of sub-regions. In relation to universities from Northern Europe, their effort on entrepreneurship support mechanisms development was proportional to their Entrepreneurial University's results. Finally, universities from Easter Europe were on the mean regarding Entrepreneurial University's results, although they were the ones that promote the most the entrepreneurship support mechanisms.

With respect to external environmental and internal organisational factors, Eastern, Northern and Western universities were above the mean on both cases. However, Southern universities did not achieve the mean (see Graph 7).
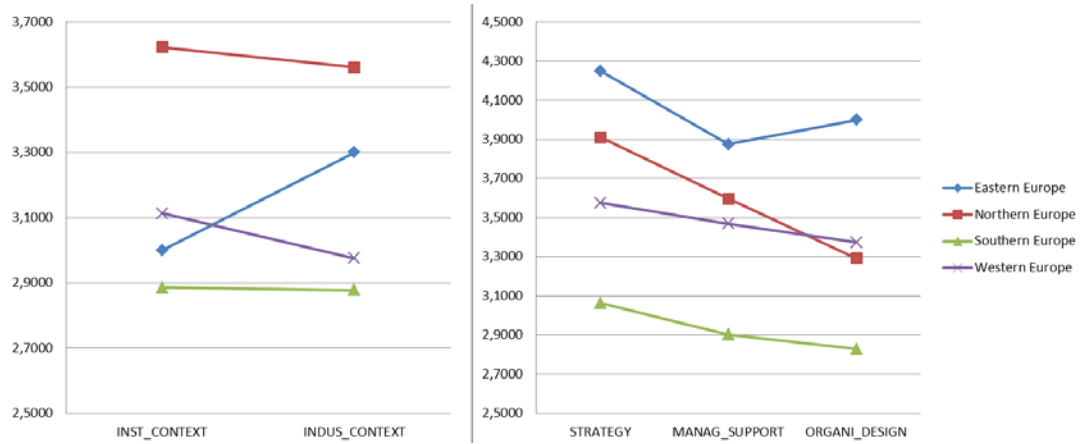
Graph 7 External and internal factors regarding geographical location

Furthermore, as it was mentioned before, due to geographical proximity, the numbers of responses from Spanish universities was higher than the rest. Specifically, out of the seventy-five surveys mailed in Spain, thrity-three were returned (44%). Because of this fact, it was interesting to analyse the differences between these two groups. Graphs below (see Graph 8, Graph 9 and Graph 10) show that Spanish universities obtained lower results on all factors, except in PR_RESEARCH.
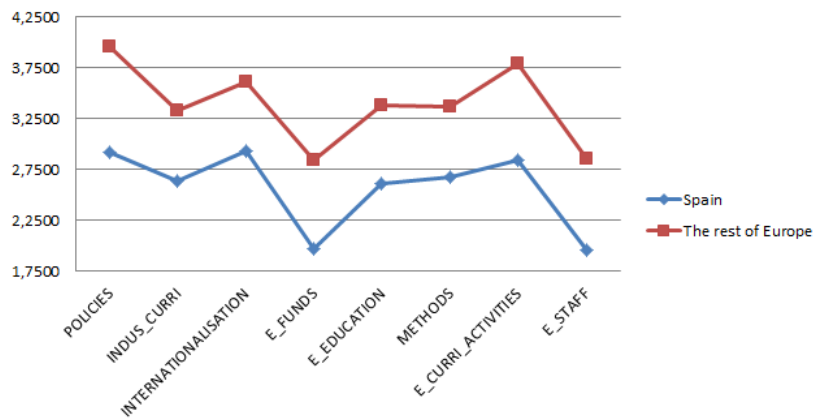
Graph 8 Entrepreneurship support mechanisms of Spanish and the rest of European universities
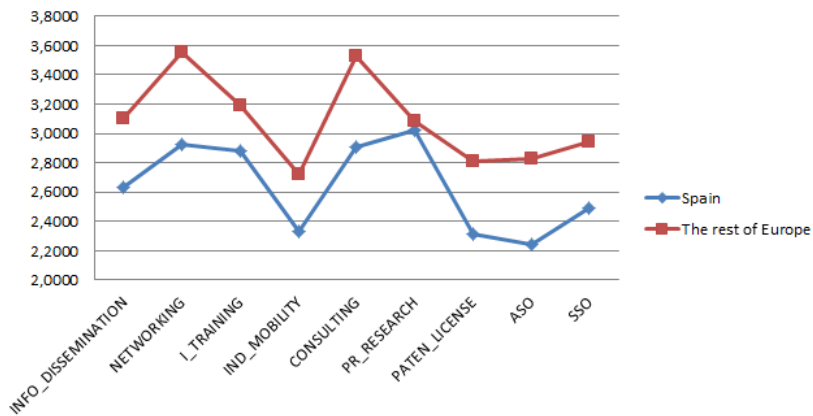
Graph 9 Entrepreneurial University's results of Spanish and the rest of European universities
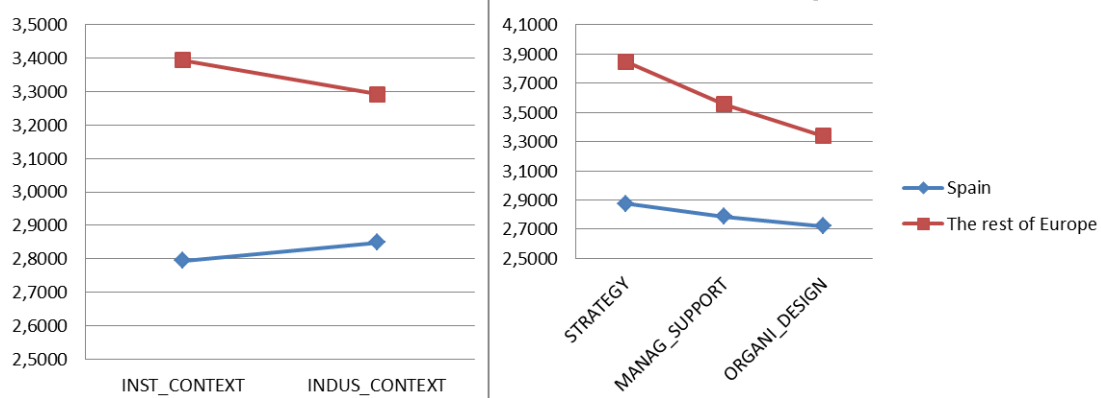
Graph 10 External and internal factors of Spanish and the rest of European universities

Once the descriptive analysis was done, the differences regarding both entrepreneurial support mechanisms and Entrepreneurial University's results between Spanish and the rest of European universities were analysed.

Specifically the *t*-test was developed, seeing that it was the most appropriate technique to analyse an independent variable that is divided into two groups. As a result, the extent to which the different independent variables were influenced by being a university from Spain or from the rest of Europe were shown. Results are compiled in Table 51.

Table 51 Student's *t*-test for independent samples applied to entrepreneurship support mechanisms in relation to the geographical location

	Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
POLICIES									
Equal variances assumed	1,770	,188	1,225	67	,225	,28550	,23299	-,17954	,75054
Equal variances not assumed			1,242	66,882	,218	,28550	,22980	-,17319	,74419
INDUS_CURRI									
Equal variances assumed	11,935	,001	-3,089	67	,003	-,53020	,17167	-,87285	-,18756
Equal variances not assumed			-3,213	57,299	,002	-,53020	,16500	-,86057	-,19983
INTERNATIONALISATION									
Equal variances assumed	9,737	,003	-1,432	67	,157	-,28726	,20056	-,68758	,11307
Equal variances not assumed			-1,482	60,342	,144	-,28726	,19383	-,67492	,10041
E_FUNDS									
Equal variances assumed	23,238	,000	-2,375	67	,020	-,49661	,20914	-,91406	-,07917
Equal variances not assumed			-2,505	48,515	,016	-,49661	,19826	-,89513	-,09810
E_EDUCATION									
Equal variances assumed	11,651	,001	-2,516	67	,014	-,53077	,21098	-,95188	-,10966
Equal variances not assumed			-2,605	60,055	,012	-,53077	,20378	-,93838	-,12316
METHODS									
Equal variances assumed	3,159	,080	-2,785	67	,007	-,52594	,18888	-,90294	-,14894
Equal variances not assumed			-2,831	66,586	,006	-,52594	,18580	-,89684	-,15503
E_CURRI_ACTIVITIES									
Equal variances assumed	8,227	,006	1,556	67	,124	,34452	,22143	-,09746	,78649
Equal variances not assumed			1,609	60,599	,113	,34452	,21410	-,08365	,77269
E_STAFF									
Equal variances assumed	3,197	,078	1,142	67	,258	,27547	,24130	-,20616	,75711
Equal variances not assumed			1,167	65,337	,247	,27547	,23602	-,19584	,74679

Regarding these entrepreneurship support mechanisms, note that the Levene statistic had an associated p-value lower than the critical significance level of 0,05 allowing the rejection of equal variances in three out of the four cases, INDUS_CURRI, E_FUNDS and E_EDUCATION. For the last case, METHODS, the Levene statistic had an associated p-value greater than the critical significance level of 0,05 allowing the assumption of equal variances. So it could be concluded that four entrepreneurship support mechanisms were different for Spanish universities and the rest of European universities. Furthermore, analysing the means of these four entrepreneurship support mechanisms (see Table 52), it was clear that the rest of European universities obtained better values than Spanish universities.

Table 52 Spanish and the rest of European universities' means regarding entrepreneurship support mechanisms

	SPAIN1_EUROPE2	N	Mean	Std. Deviation	Std. Error Mean
POLICIES	1	32	3,6147	,86398	,15273
	2	37	3,3292	1,04439	,17170
INDUS_CURRI	1	32	2,7125	,47366	,08373
	2	37	3,2427	,86482	,14218
INTERNATIONALISATION	1	32	3,1303	,59761	,10564
	2	37	3,4176	,98849	,16251
E_FUNDS	1	32	2,1591	,44142	,07803
	2	37	2,6557	1,10862	,18226
E_EDUCATION	1	32	2,7303	,62411	,11033
	2	37	3,2611	1,04214	,17133
METHODS	1	32	2,7541	,68389	,12090
	2	37	3,2800	,85822	,14109
E_CURRI_ACTIVITIES	1	32	3,5234	,66405	,11739
	2	37	3,1789	1,08909	,17904
E_STAFF	1	32	2,5725	,82642	,14609
	2	37	2,2970	1,12755	,18537

Once the means comparison was developed, it was necessary to check the basic hypothesis of the *t*-test; in order to ensure that the previous analysis was consistent. In the four cases the *t* statistic took a bilateral critical significance level under the critical value of 0,05, rejecting the null hypothesis of equal means. Thus, it could be concluded that Spanish universities promote less INDUS_CURRI, E_FUNDS, E_EDUCATION and METHODS than the rest of European Universities.

Concerning Entrepreneurial University's results (see Table 53), note that the Levene statistic had an associated p-value lower than the critical significance level of 0,05 allowing the rejection of equal variances for a single variable: SSO. So it could be concluded that Spanish universities and the rest of European universities had significant differences only in SSO; indeed, the rest of European universities obtained better results on SSO than Spanish universities (see Table 54).

Once a first approach regarding the differences between Spanish and the rest of European universities was performed, the next step was to analyse the influence of entrepreneurship support mechanisms on Entrepreneurial University's results for these two scenarios. Indeed, as SSO was the only academic entrepreneurship activity that was significantly different for both groups, the further analysis was focused on this variable. In order to achieve this goal, a stepwise multiple regression analysis was applied for both scenarios: Spain and the rest of Europe.

Table 53 Student's *t*-test for independent samples applied to Entrepreneurial University's results in relation to the geographical location

	Levene's Test for Equality of Variances		t-test for Equality of Means							
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference		
								Lower	Upper	
INFO_DISSEMIN.										
Equal variances assumed	9,935	,002	-1,718	67	,090	-,25378	,14768	-,54855	,04098	
Equal variances not assumed			-1,789	56,923	,079	-,25378	,14185	-,53785	,03028	
NETWORKING										
Equal variances assumed	3,499	,066	-,491	67	,625	-,07413	,15090	-,37533	,22707	
Equal variances not assumed			-,504	64,169	,616	-,07413	,14707	-,36792	,21966	
I_TRAINING										
Equal variances assumed	3,124	,082	-,946	67	,348	-,19764	,20896	-,61472	,21945	
Equal variances not assumed			-,967	65,336	,337	-,19764	,20438	-,60577	,21050	
IND_MOBILITY										
Equal variances assumed	10,46	,002	-,188	67	,852	-,02851	,15174	-,33138	,27437	
Equal variances not assumed			-,197	51,822	,844	-,02851	,14458	-,31865	,26164	
CONSULTING										
Equal variances assumed	2,146	,148	,470	67	,640	,09206	,19595	-,29906	,48318	
Equal variances not assumed			,479	65,810	,633	,09206	,19200	-,29130	,47542	
PR_RESEARCH										
Equal variances assumed	,694	,408	1,091	67	,279	,19130	,17537	-,15875	,54135	
Equal variances not assumed			1,106	66,898	,273	,19130	,17301	-,15404	,53664	
PATENT_LICENSE										
Equal variances assumed	3,441	,068	,861	67	,392	,12336	,14326	-,16259	,40932	
Equal variances not assumed			,879	65,675	,382	,12336	,14030	-,15678	,40350	
ASO										
Equal variances assumed	,005	,942	-,310	67	,758	-,04257	,13739	-,31680	,23166	
Equal variances not assumed			-,309	65,088	,758	-,04257	,13763	-,31743	,23229	
SSO										
Equal variances assumed	5,539	,022	-2,147	67	,035	-,30912	,14396	-,59647	-,02177	
Equal variances not assumed			-2,229	58,691	,030	-,30912	,13871	-,58670	-,03154	

Table 54 Spanish and the rest of European universities' means regarding Entrepreneurial University's results

	SPAIN1_EUROPE2	N	Mean	Std. Deviation	Std. Error Mean
INFO_DISSEMINATION	1	32	2,7400	,40354	,07134
	2	37	2,9938	,74582	,12261
NETWORKING	1	32	3,2134	,49775	,08799
	2	37	3,2876	,71683	,11785
I_TRAINING	1	32	2,9375	,71561	,12650
	2	37	3,1351	,97645	,16053
IND_MOBILITY	1	32	2,5191	,35915	,06349
	2	37	2,5476	,79010	,12989
CONSULTING	1	32	3,2813	,68318	,12077
	2	37	3,1892	,90792	,14926
PR_RESEARCH	1	32	3,1556	,65157	,11518
	2	37	2,9643	,78526	,12910
PATENT_LICENSE	1	32	2,6369	,49683	,08783
	2	37	2,5135	,66551	,10941
ASO	1	32	2,5250	,57642	,10190
	2	37	2,5676	,56276	,09252
SSO	1	32	2,5625	,41153	,07275
	2	37	2,8716	,71836	,11810

To do this, firstly the correlation matrix between variables was studied for both scenarios. These matrixes show that there were no highly significant correlations between the variables, which a priori indicated no multicollinearity problems in the regression between the variables raised (see Table 55 and Table 56). Moreover, this fact was further corroborated by calculating collinearity statistics; both, the tolerance and the variance inflation factor (onwards VIF). Both statistics

were well above the minimum tolerance limit, which meant that the theoretical values of these regressions were not adversely affected by multicollinearity.

Table 55 Correlation between SSO and entrepreneurship support mechanisms of Spanish universities (n=32)

		1	2	3	4	5	6	7	8	9
1	Pearson Correlation	1	-,006	-,161	,055	,112	,214	,166	,378*	,208
	Sig. (2-tailed)		,976	,378	,764	,543	,239	,365	,033	,254
2	Pearson Correlation	-,006	1	-,090	,240	,427*	,298	,248	,630**	,260
	Sig. (2-tailed)	,976		,625	,185	,015	,097	,170	,000	,151
3	Pearson Correlation	-,161	-,090	1	,236	,073	,216	,055	-,219	-,005
	Sig. (2-tailed)	,378	,625		,194	,691	,235	,765	,229	,978
4	Pearson Correlation	,055	,240	,236	1	,247	,103	-,142	,167	,293
	Sig. (2-tailed)	,764	,185	,194		,173	,576	,439	,361	,103
5	Pearson Correlation	,112	,427*	,073	,247	1	,212	,204	,417*	,470**
	Sig. (2-tailed)	,543	,015	,691	,173		,244	,263	,018	,007
6	Pearson Correlation	,214	,298	,216	,103	,212	1	,368*	,366*	,276
	Sig. (2-tailed)	,239	,097	,235	,576	,244		,038	,039	,126
7	Pearson Correlation	,166	,248	,055	-,142	,204	,368*	1	,256	,176
	Sig. (2-tailed)	,365	,170	,765	,439	,263	,038		,157	,335
8	Pearson Correlation	1	-,006	-,161	,055	,112	,214	,166	,378*	,208
	Sig. (2-tailed)		,976	,378	,764	,543	,239	,365	,033	,254
9	Pearson Correlation	-,006	1	-,090	,240	,427*	,298	,248	,630**	,260
	Sig. (2-tailed)	,976		,625	,185	,015	,097	,170	,000	,151

Table 56 Correlation between SSO and entrepreneurship support mechanisms of the rest of European universities (n=37)

		1	2	3	4	5	6	7	8	9
1	Pearson Correlation	1	,620**	,538**	,529**	,658**	,405*	,608**	,674**	,577**
	Sig. (2-tailed)		,000	,001	,001	,000	,013	,000	,000	,000
2	Pearson Correlation	,620**	1	,775**	,708**	,731**	,543**	,737**	,741**	,564**
	Sig. (2-tailed)	,000		,000	,000	,000	,001	,000	,000	,000
3	Pearson Correlation	,538**	,775**	1	,739**	,598**	,503**	,622**	,595**	,471**
	Sig. (2-tailed)	,001	,000		,000	,000	,002	,000	,000	,003
4	Pearson Correlation	,529**	,708**	,739**	1	,575**	,572**	,728**	,573**	,550**
	Sig. (2-tailed)	,001	,000	,000		,000	,000	,000	,000	,000
5	Pearson Correlation	,658**	,731**	,598**	,575**	1	,571**	,623**	,839**	,670**
	Sig. (2-tailed)	,000	,000	,000	,000		,000	,000	,000	,000
6	Pearson Correlation	,405*	,543**	,503**	,572**	,571**	1	,723**	,655**	,662**
	Sig. (2-tailed)	,013	,001	,002	,000	,000		,000	,000	,000
7	Pearson Correlation	,608**	,737**	,622**	,728**	,623**	,723**	1	,721**	,622**
	Sig. (2-tailed)	,000	,000	,000	,000	,000	,000		,000	,000
8	Pearson Correlation	,674**	,741**	,595**	,573**	,839**	,655**	,721**	1	,717**
	Sig. (2-tailed)	,000	,000	,000	,000	,000	,000	,000		,000
9	Pearson Correlation	,577**	,564**	,471**	,550**	,670**	,662**	,622**	,717**	1
	Sig. (2-tailed)	,000	,000	,003	,000	,000	,000	,000	,000	

1-SSO; 2-POLICIES; 3-INDUS_CURRI; 4-INTERNATIONAL., 5-E_FUNDS; 6-E_EDUCATION; 7-METHODS; 8-E_CURRI_ACTIV.; 9-E_STAFF
**. Correlation is significant at the 0,01 level (2-tailed).
*. Correlation is significant at the 0,05 level (2-tailed).

Once the multicollinearity was analysed, the stepwise multiple regression analysis was applied in order to measure the influence of the entrepreneurship support mechanisms on SSO in Spain and in the rest of Europe. Thus, through the corresponding stepwise multiple regression analysis (see Table 57 and Table 58) it was shown that for both scenarios the key entrepreneurship support factor was the same, named E_CURRI_ACTIVITIES. Thus, it could be stated that for European universities the support through the whole entrepreneurship process was a key factor for generating SSO.

Table 57 Multiple linear regressions between SSO generation and the entrepreneurship support mechanisms of Spanish universities

Model Summary

Model	R SPAIN1_EUROPE2 = 1 (Selected)	R Square	Adjusted R Square	Std. Error of the Estimate
1	,378[a]	,143	,114	,38727

a. Predictors: (Constant), E_CURRI_ACTIVITIES

ANOVA[a,b]

Model		Sum of Squares	df	Mean Square	F	Sig.
	Regression	,751	1	,751	5,004	,033[c]
1	Residual	4,499	30	,150		
	Total	5,250	31			

a. Dependent Variable: SSO
b. Selecting only cases for which SPAIN1_EUROPE2 = 1
c. Predictors: (Constant), E_CURRI_ACTIVITIES

Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	1,737	,375		4,627	,000		
	E_CURRI_ACTIVITIES	,234	,105	,378	2,237	,033	1,000	1,000

a. Dependent Variable: SSO
b. Selecting only cases for which SPAIN1_EUROPE2 = 1

Table 58 Multiple linear regressions between SSO generation and the entrepreneurship support mechanisms of the rest of European universities

Model Summary

Model	R SPAIN1_EUROPE2 = 2 (Selected)	R Square	Adjusted R Square	Std. Error of the Estimate
1	,674[a]	,454	,438	,53840

a. Predictors: (Constant), E_CURRI_ACTIVITIES

ANOVA[a,b]

Model		Sum of Squares	df	Mean Square	F	Sig.
	Regression	8,432	1	8,432	29,088	,000[c]
1	Residual	10,146	35	,290		
	Total	18,578	36			

a. Dependent Variable: SSO
b. Selecting only cases for which SPAIN1_EUROPE2 = 2
c. Predictors: (Constant), E_CURRI_ACTIVITIES

Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	1,459	,276		5,277	,000		
	E_CURRI_ACTIVITIES	,444	,082	,674	5,393	,000	1,000	1,000

a. Dependent Variable: SSO
b. Selecting only cases for which SPAIN1_EUROPE2 = 2

5.2.2 Ownership status

Various authors (e.g. Adams and Griliches (1998), Lach and Schankerman (2008), discussed the differences between private and public universities, since on the one hand, public universities are mainly dependent on their only customer, their politically assigned, mostly regional, government, which it can neither select nor replace (Gaus and Raith, 2013); and on the other hand, private universities (which

receive revenues in the form of tuition fees from students) have strong financial pressure, derived from their sponsors and the market, to respond to local stakeholders (Gibb and Hannon, 2005). Thus, through the present section the differences between public and private universities were analysed.

Regarding entrepreneurial support mechanisms (see Graph 11), public universities obtained better results on almost all the variables; except in E_EDUCATION and METHODS. The values of the two latter were quite similar for both types of universities. Analysing Entrepreneurial University's results (see Graph 12), both types of universities obtained quite similar values in Soft AEA; indeed, the only variable that stands out was I_TRAINING, since private universities obtained better values than the rest. As for Hard AEA, private universities showed worst results than public ones.
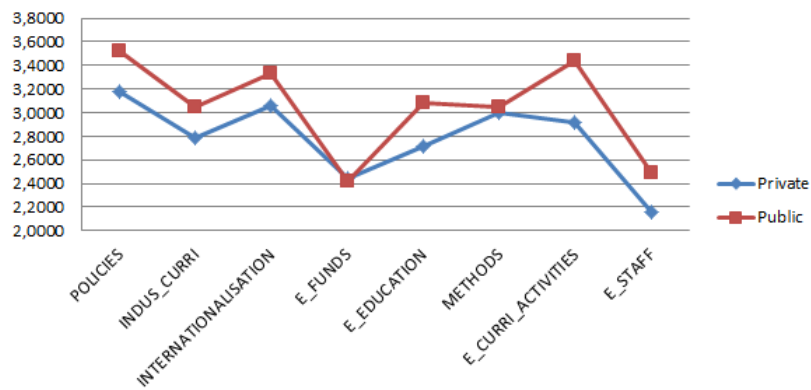
Graph 11 Entrepreneurship support mechanisms regarding the ownership status
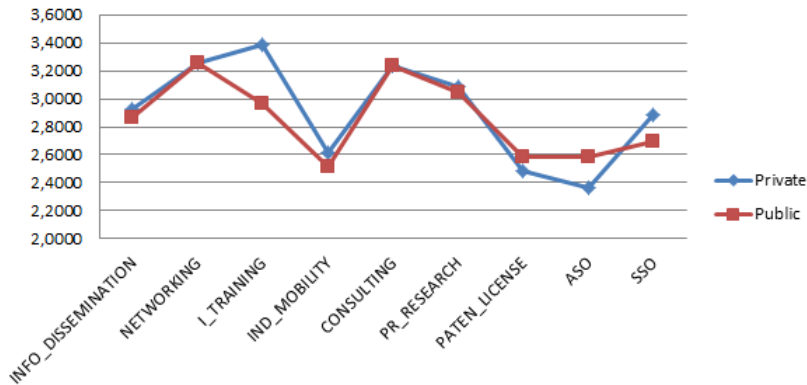
Graph 12 Entrepreneurial University's results regarding the ownership status

With respect to external variables, as it is shown in Graph 13, public universities obtained much support from INST_CONTEXT; however, regarding INDUS_CONTEXT both types of universities obtained similar results. Moving on to internal organisation variables, both types of universities obtained similar results.

Graph 13 External and internal factors regarding the ownership status

Once the descriptive analysis was done, the differences regarding both entrepreneurial support mechanisms and Entrepreneurial University's results between private and public universities were analysed through a formal statistical test. Indeed, a *t*-test was developed; replicating the analysis explained in the previous section but using the OWNERSHIP STATUS as the independent variable. Note that the *t* statistic took values in a bilateral critical level higher than 0,05 for all the variables, thus it could be concluded that there were not significant differences on entrepreneurship support mechanisms between public and private universities (see Table 59).

Table 59 Student's *t*-test for independent samples applied to entrepreneurship support mechanisms in relation to the ownership status

	Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
POLICIES									
Equal variances assumed	,072	,789	-1,170	67	,246	-,34791	,29741	-,94155	,24573
Equal variances not assumed			-1,205	18,633	,243	-,34791	,28875	-,95308	,25725
INDUS_CURRI									
Equal variances assumed	3,080	,084	-,633	67	,529	-,14772	,23329	-,61338	,31794
Equal variances not assumed			-,829	27,489	,414	-,14772	,17816	-,51297	,21753
INTERNATIONALISATION									
Equal variances assumed	,183	,670	-1,368	67	,176	-,35036	,25611	-,86156	,16085
Equal variances not assumed			-1,489	19,997	,152	-,35036	,23531	-,84121	,14050
E_FUNDS									
Equal variances assumed	3,606	,062	-1,665	67	,101	-,45302	,27214	-,99621	,09017
Equal variances not assumed			-2,190	27,776	,037	-,45302	,20682	-,87682	-,02923
E_EDUCATION									
Equal variances assumed	,072	,789	,053	67	,958	,01478	,28147	-,54704	,57660
Equal variances not assumed			,052	17,984	,959	,01478	,28178	-,57726	,60682
METHODS									
Equal variances assumed	,541	,465	,086	67	,932	,02188	,25442	-,48593	,52970
Equal variances not assumed			,099	21,860	,922	,02188	,22003	-,43459	,47836
E_CURRI_ACTIVITIES									
Equal variances assumed	1,651	,203	-1,303	67	,197	-,36993	,28387	-,93653	,19667
Equal variances not assumed			-1,547	22,821	,136	-,36993	,23911	-,86478	,12492
E_STAFF									
Equal variances assumed	1,228	,272	-1,618	67	,110	-,49306	,30481	-1,10147	,11534
Equal variances not assumed			-1,788	20,440	,089	-,49306	,27569	-1,06736	,08123

Regarding Entrepreneurial University's results (see Table 60), note that the Levene statistic had an associated p-value higher than the critical significance level of 0,05

allowing the assumption of equal variances for two cases, PATENT_LICENSE and ASO. So it could be concluded that public and private universities had significant differences only in PATENT_LICENSE and ASO; specifically, the rest of public universities obtained better results on both PATENT_LICENSE and ASO than in private universities (see Table 61).

Table 60 Student's *t*-test for independent samples applied to Entrepreneurial University's results in relation to the ownership status

	Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
INFO_DISSEMIN.									
Equal variances assumed	0,748	0,39	0,187	67	0,852	0,03593	0,19239	-0,34808	0,41994
Equal variances not assumed			0,205	20,168	0,84	0,03593	0,17568	-0,33033	0,40219
NETWORKING									
Equal variances assumed	0,171	0,68	0,473	67	0,637	0,09113	0,19247	-0,29304	0,47529
Equal variances not assumed			0,506	19,539	0,618	0,09113	0,17992	-0,28476	0,46701
I_TRAINING									
Equal variances assumed	0,032	0,858	0,2	67	0,842	0,05357	0,26818	-0,48171	0,58885
Equal variances not assumed			0,193	17,316	0,85	0,05357	0,27814	-0,53244	0,63958
IND_MOBILITY									
Equal variances assumed	0,115	0,736	-0,178	67	0,859	-0,03445	0,19352	-0,42072	0,35182
Equal variances not assumed			-0,169	17,033	0,868	-0,03445	0,20402	-0,46483	0,39593
CONSULTING									
Equal variances assumed	1,754	0,19	0,385	67	0,702	0,09615	0,25003	-0,40291	0,59522
Equal variances not assumed			0,434	21,09	0,668	0,09615	0,22133	-0,36402	0,55633
PR_RESEARCH									
Equal variances assumed	0,016	0,901	-1,258	67	0,213	-0,28059	0,22301	-0,72572	0,16454
Equal variances not assumed			-1,22	17,419	0,239	-0,28059	0,22998	-0,76491	0,20373
PATENT_LICENSE									
Equal variances assumed	1,753	0,19	1,991	67	0,051	0,35537	0,17851	-0,00093	0,71167
Equal variances not assumed			1,847	16,673	0,083	0,35537	0,19241	-0,05119	0,76193
ASO									
Equal variances assumed	0,006	0,939	1,957	67	0,054	0,33379	0,17053	-0,00659	0,67417
Equal variances not assumed			2,134	20,045	0,045	0,33379	0,15641	0,00758	0,66
SSO									
Equal variances assumed	0,03	0,862	1,507	67	0,137	0,28125	0,18667	-0,09135	0,65385
Equal variances not assumed			1,622	19,708	0,121	0,28125	0,17337	-0,08074	0,64324

Table 61 Public and private universities' means regarding Entrepreneurial University's results

	PUBLIC1_PRIVATE0	N	Mean	Std. Deviation	Std. Error Mean
INFO_DISSEMINATION	1	56	2,8829	,63945	,08545
	0	13	2,8469	,55343	,15350
NETWORKING	1	56	3,2704	,63622	,08502
	0	13	3,1792	,57173	,15857
I_TRAINING	1	56	3,0536	,86170	,11515
	0	13	3,0000	,91287	,25318
IND_MOBILITY	1	56	2,5279	,61859	,08266
	0	13	2,5623	,67252	,18652
CONSULTING	1	56	3,2500	,83666	,11180
	0	13	3,1538	,68874	,19102
PR_RESEARCH	1	56	3,0002	,71784	,09593
	0	13	3,2808	,75362	,20902
PATENT_LICENSE	1	56	2,6377	,56638	,07569
	0	13	2,2823	,63782	,17690
ASO	1	56	2,6107	,56622	,07566
	0	13	2,2769	,49355	,13689
SSO	1	56	2,7813	,61803	,08259
	0	13	2,5000	,54962	,15244

5.2.3   Owning an engineering faculty

Studies on entrepreneurship activities have largely focused on the biomedical sciences, engineering, mathematics and statistics, and the physical sciences (Grimaldi et al., 2011); although all academic disciplines do not develop equally entrepreneurship activities (Baldini, 2010). Moreover, in the recent years, governments have been stimulating technological entrepreneurship within the universities, because of the rapid increase in technology based economic development initiatives (Grimaldi et al., 2011); encouraging the need of further research on these last disciplines.

Indeed, the importance of technology within entrepreneurship towards the creation of both individual and regional wealth has recently generated considerable interest (Venkataraman, 2004). Furthermore, several special issues have focused specifically on technology based entrepreneurship (Mowery and Shane, 2002, Shane and Venkataraman, 2003, Wright et al., 2007); due to the substantial increase in the use of technology commercialisation as a platform for creating new ventures (Wright et al., 2007). Technological innovation has long been viewed as an integral part of entrepreneurship (Drucker, 1985), therefore engineering faculties are the most important inputs for academic entrepreneurship.

From this point of view, it was interesting to analyse the influence of integrating an engineering faculty within the university. As it is shown in Graph 14, universities that integrated an engineering faculty obtained slightly better results on entrepreneurship support mechanisms than the rest; except for METHODS, since all universities obtained the same results. Moreover, it was worth highlighting the variable which had a higher difference between the two groups, E_CURRI_ACTIVITIES.
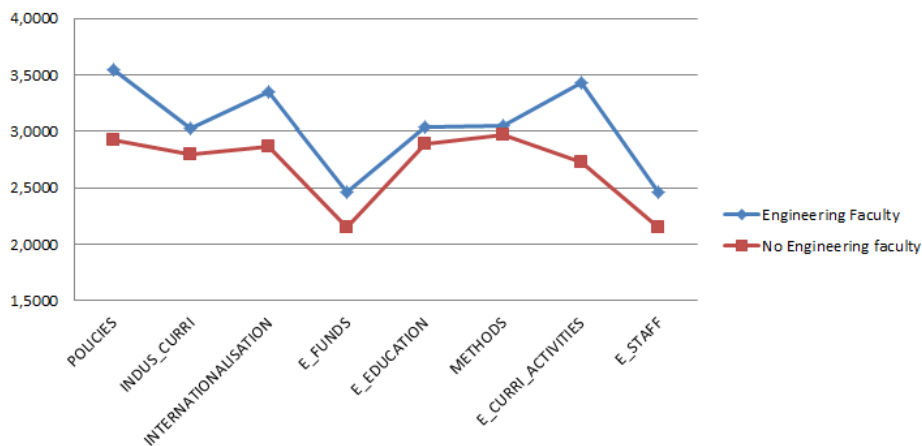
Graph 14 Entrepreneurship support mechanisms regarding the engineering faculty

With respect to Entrepreneurial University's results (see Graph 15), note that universities that integrated an engineering faculty obtained better results than the rest in all Entrepreneurial University's results, except for ASO. Certainly, all universities obtained almost the same results in regard to ASO. Moving on to

external and internal variables (see Graph 16), it seems that universities that integrated an engineering faculty obtained more support from their environment that the rest, specifically from the industrial context. Furthermore, the same thing happens with internal variables, since universities that integrated an engineering faculty obtained better results regarding these variables than the rest. Concretely, they obtained a higher support from their management team than the rest.
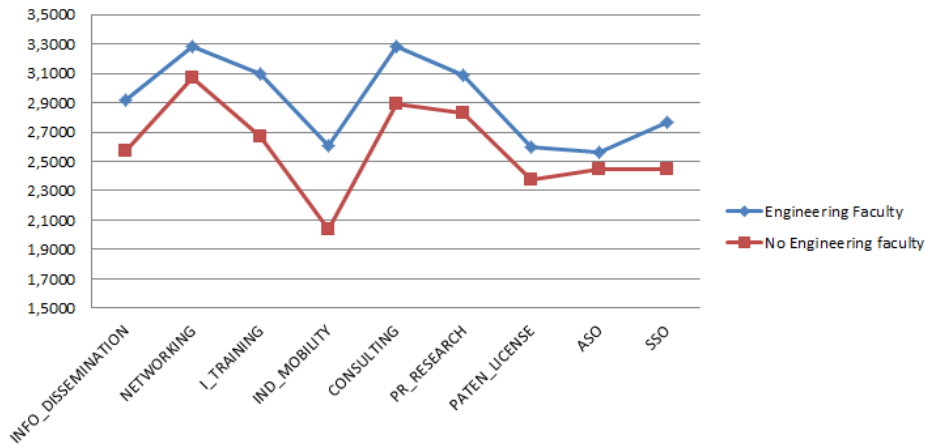
Graph 15 Entrepreneurial University's results regarding the engineering faculty
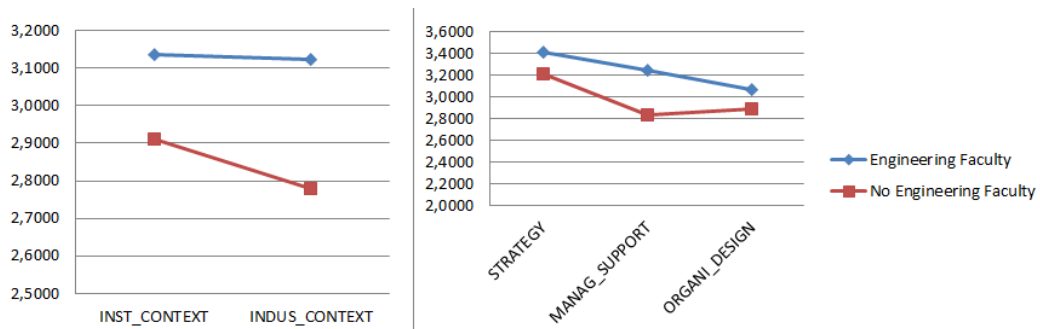
Graph 16 External and internal variables regarding the engineering faculty

Once the descriptive analysis was done, the differences between universities that integrated an engineering faculty and the ones that not were analysed; thus, the analysis developed in the previous section was replicated using the possession of an engineering faculty as the independent variable.

Specifically student's *t*-test was developed, seeing that it is the most appropriate technique to analyse an independent variable that is divided into two groups. As a result, the extent to which the different independent variables were influenced by integrating an engineering faculty was identified. As it was shown in Table 62, the only variable which had a significant difference between the two groups was E_CURRI_ACTIVITIES.

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Table 62 Student's *t*-test for independent samples applied to entrepreneurship support mechanisms in relation to the engineering faculty

	Levene's Test for Equality of Variances		t-test for Equality of Means							
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
POLICIES									
Equal variances assumed	0,52	0,473	-1,806	67	0,075	-0,61517	0,34064	-1,29509	0,06476
Equal variances not assumed			-1,641	9,948	0,132	-0,61517	0,37491	-1,45112	0,22078
INDUS_CURRI									
Equal variances assumed	1,601	0,21	-0,837	67	0,405	-0,22633	0,27027	-0,7658	0,31314
Equal variances not assumed			-1,047	12,868	0,314	-0,22633	0,2162	-0,69388	0,24122
INTERNATION.									
Equal variances assumed	2,011	0,161	-1,647	67	0,104	-0,48672	0,29557	-1,07669	0,10325
Equal variances not assumed			-2,242	14,348	0,041	-0,48672	0,21713	-0,95136	-0,02208
E_FUNDS									
Equal variances assumed	0,11	0,741	-0,993	67	0,324	-0,31794	0,3201	-0,95687	0,32098
Equal variances not assumed			-1,005	10,636	0,337	-0,31794	0,31627	-1,01697	0,38109
E_EDUCATION									
Equal variances assumed	0,076	0,784	-0,448	67	0,656	-0,14622	0,32633	-0,79759	0,50514
Equal variances not assumed			-0,455	10,66	0,658	-0,14622	0,32137	-0,85631	0,56387
METHODS									
Equal variances assumed	2,95	0,091	-0,283	67	0,778	-0,08367	0,29524	-0,67297	0,50564
Equal variances not assumed			-0,427	16,912	0,675	-0,08367	0,19593	-0,4972	0,32987
E_CURRI_ACTIVI.									
Equal variances assumed	0,05	0,824	-2,2	67	0,031	-0,70894	0,32232	-1,35229	-0,0656
Equal variances not assumed			-2,092	10,215	0,062	-0,70894	0,33881	-1,4617	0,04382
E_STAFF									
Equal variances assumed	0,155	0,695	-0,892	67	0,376	-0,31983	0,35864	-1,03568	0,39601
Equal variances not assumed			-0,915	10,738	0,38	-0,31983	0,34959	-1,09158	0,45191

Once the means comparison was developed, it was necessary to check the basic hypothesis of the *t*-test; in order to ensure that the previous analysis was consistent. For the variable E_CURRI_ACTIVITIES the *t* statistic took a bilateral critical significance level under the critical value of 0,05, rejecting the null hypothesis of equal means. Thus, it could be concluded that universities that integrated an engineering faculty obtained better results on E_CURRI_ACTIVITIES than the rest (see Table 63).

Table 63 Means of universities that integrate an engineering faculty and not regarding entrepreneurship support mechanisms

	ENGINEERING_FACULTY	N	Mean	Std. Deviation	Std. Error Mean
POLICIES	0	9	2,9267	1,06461	,35487
	1	60	3,5418	,93679	,12094
INDUS_CURRI	0	9	2,8000	,57446	,19149
	1	60	3,0263	,77747	,10037
INTERNATIONALISATION	0	9	2,8611	,56057	,18686
	1	60	3,3478	,85663	,11059
E_FUNDS	0	9	2,1489	,88290	,29430
	1	60	2,4668	,89718	,11583
E_EDUCATION	0	9	2,8878	,89660	,29887
	1	60	3,0340	,91512	,11814
METHODS	0	9	2,9633	,48379	,16126
	1	60	3,0470	,86194	,11128
E_CURRI_ACTIVITIES	0	9	2,7222	,95561	,31854
	1	60	3,4312	,89412	,11543
E_STAFF	0	9	2,1467	,97352	,32451
	1	60	2,4665	1,00727	,13004

Then, the behaviour of dependent variables was analysed (see Table 64). As it is appreciated, two dependent variables were influenced by the independent variable ENGINEERING_FACULTY; specifically IND_MOBILITY and CONSULTING. Furthermore, both variables obtained higher values on universities that integrate an engineering faculty (see Table 65).

Table 64 Student's *t*-test for independent samples applied to Entrepreneurial University's results in relation to the engineering faculty

	Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
INFO_DISSEMIN.									
Equal variances assumed	0,707	0,404	-1,617	67	0,11	-0,35456	0,2192	-0,79208	0,08297
Equal variances not assumed			-1,904	12,068	0,081	-0,35456	0,1862	-0,75999	0,05088
NETWORKING									
Equal variances assumed	0,146	0,704	-0,93	67	0,356	-0,20683	0,22241	-0,65077	0,23711
Equal variances not assumed			-1,075	11,855	0,304	-0,20683	0,19242	-0,62666	0,21299
I_TRAINING									
Equal variances assumed	0,91	0,344	-1,412	67	0,163	-0,43333	0,30694	-1,04599	0,17932
Equal variances not assumed			-2,136	17,035	0,048	-0,43333	0,2029	-0,86134	-0,00532
IND_MOBILITY									
Equal variances assumed	0,285	0,595	-2,693	67	0,009	-0,57489	0,21349	-1,00102	-0,14875
Equal variances not assumed			-3,365	12,861	0,005	-0,57489	0,17086	-0,94442	-0,20536
CONSULTING									
Equal variances assumed	6,399	0,014	-1,376	67	0,173	-0,39444	0,28661	-0,96652	0,17763
Equal variances not assumed			-2,532	27,431	0,017	-0,39444	0,15576	-0,71381	-0,07508
PR_RESEARCH									
Equal variances assumed	0,027	0,871	-0,971	67	0,335	-0,25267	0,26015	-0,77194	0,2666
Equal variances not assumed			-1,02	10,924	0,33	-0,25267	0,24778	-0,7985	0,29317
PATENT_LICENSE									
Equal variances assumed	0,018	0,894	-1,079	67	0,284	-0,22828	0,21147	-0,65038	0,19383
Equal variances not assumed			-1,268	12,041	0,229	-0,22828	0,18004	-0,62039	0,16384
ASO									
Equal variances assumed	2,144	0,148	-0,585	67	0,56	-0,11889	0,20306	-0,52421	0,28643
Equal variances not assumed			-0,985	21,386	0,336	-0,11889	0,12072	-0,36967	0,13189
SSO									
Equal variances assumed	0,413	0,522	-1,506	67	0,137	-0,32639	0,21675	-0,75902	0,10624
Equal variances not assumed			-1,732	11,803	0,109	-0,32639	0,1884	-0,73764	0,08486

Table 65 Means of universities that integrate an engineering faculty and not regarding Entrepreneurial University's results

	ENGINEERING_FACULTY	N	Mean	Std. Deviation	Std. Error Mean
INFO_DISSEMINATION	0	9	2,5678	,50311	,16770
	1	60	2,9223	,62666	,08090
NETWORKING	0	9	3,0733	,52235	,17412
	1	60	3,2802	,63454	,08192
I_TRAINING	0	9	2,6667	,50000	,16667
	1	60	3,1000	,89632	,11571
IND_MOBILITY	0	9	2,0344	,45407	,15136
	1	60	2,6093	,61410	,07928
CONSULTING	0	9	2,8889	,33333	,11111
	1	60	3,2833	,84556	,10916
PR_RESEARCH	0	9	2,8333	,68699	,22900
	1	60	3,0860	,73314	,09465
PATENT_LICENSE	0	9	2,3722	,48674	,16225
	1	60	2,6005	,60442	,07803
ASO	0	9	2,4444	,27889	,09296
	1	60	2,5633	,59659	,07702
SSO	0	9	2,4444	,51201	,17067
	1	60	2,7708	,61804	,07979

5.3 TESTING THE PROPOSED ENTREPRENEURIAL UNIVERSITY MODEL

In order to understand the simultaneous links between environmental external factors, internal organisation factors, entrepreneurship support mechanisms and Entrepreneurial University's results, diverse models were created and through the present section the testing of these models is shown using a variance-based SEM approach, specifically, the PLS-SEM approach. The assessment of a PLS-SEM path model commenced with the estimation of the outer model (i.e. measurement model) in terms of reliability and construct validity, followed by the assessment of the path relations of the inner model (i.e. structural model) (Henseler et al., 2009).

Assessment of Measurement Model: Firstly, internal consistency reliability was assessed by examining composite reliability values (onwards, CR) that should not be lower than 0,60 (Henseler et al., 2009). In addition, standardised outer factor loadings were examined which should exceed 0,70, which indicated adequate indicator reliability (Henseler et al., 2009, Hair et al., 2011). Furthermore, convergent validity was examined by using average variance extracted (onwards, AVE) as a criterion with values greater than 0,50 indicating adequate convergent validity (Henseler et al., 2009, Hair et al., 2011). The AVE value of 0,50 referred to the fact that half of the variance of the manifest variable was explained by the latent variable on average (Henseler et al., 2009).

Finally, discriminant validity was assessed, which referred to the extent to which measurement scale items were distinct from items of other conceptually distinct latent constructs. To this end, the Fornell-Larcker Criterion (Fornell and Larcker, 1981) was used which refers to the condition where a latent variable shares more variance with its assigned indicators than with any other latent variable. In statistical terms this was assessed by observing that the AVE value of each latent construct should be higher than the construct's highest squared correlation with any other latent construct (Henseler et al., 2009, Hair et al., 2011).

Assessment of Structural Model: To the examination of the outer model in terms of reliability and validity, the inner model was assessed. Key criteria for the assessment of the inner model were the coefficient of determination (R^2), the path coefficient and prediction relevance (Q^2) (Hair et al., 2011). The following table (see Table 66) summarised the measures and threshold values applied in this research for testing the inner model in PLS-SEM.

Table 66 Measures and threshold values for assessment of inner model (based on Henseler et al. (2009) and Hair et al. (2011))

Assessment Subject	Measure	Threshold value
Coefficient of determination	R^2	0,19 (weak), 0,33 (moderate), 0,67 (substantial)
Path Coefficient	t-value	1,65 (+p<0,1), 1,96 (*p<0,05), 2,58 (**p<0,01), 3,26 (***p<0,001)
Predictive Relevance	Q^2	0,02 (small), 0,15 (medium), 0,35 (strong)

5.3.1 Direct impact on Entrepreneurial University's results

Based on this PLS approach, the first model to be tested (see Figure 17) was the one which analysed the simultaneous links between environmental external factors, internal organisational factors and entrepreneurship support mechanisms on Entrepreneurial University's results.
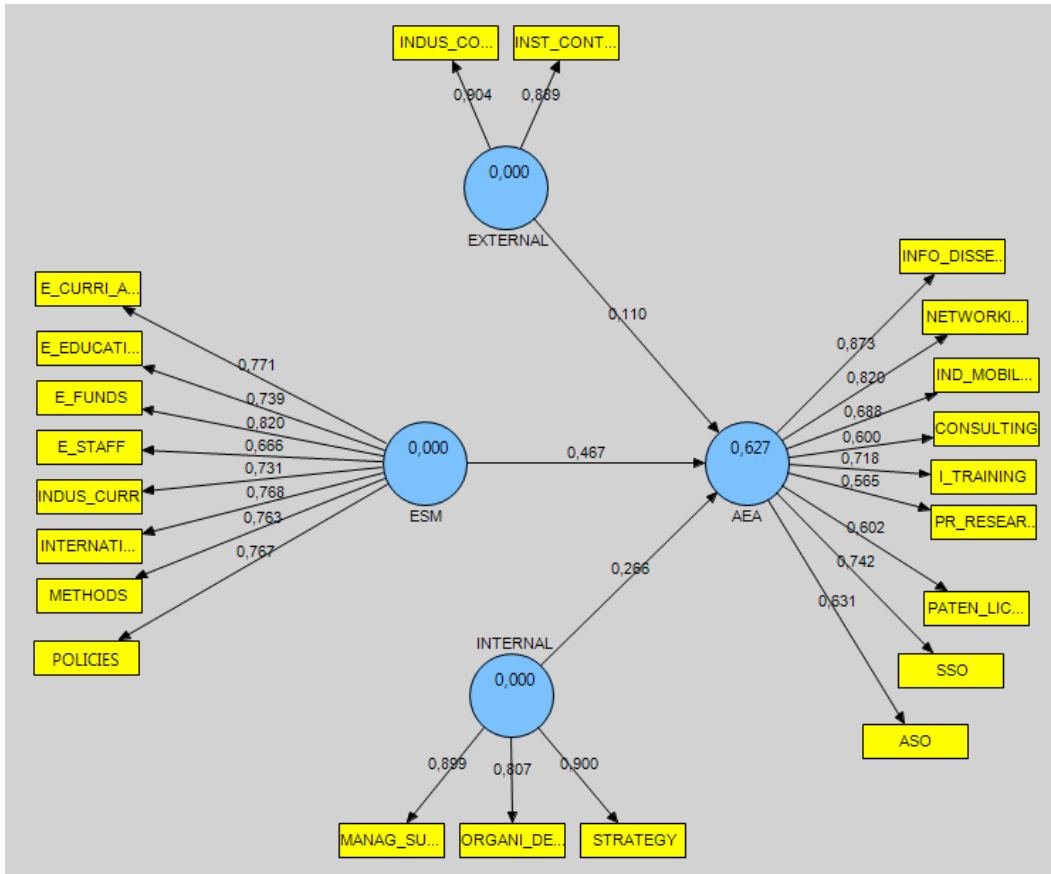
Figure 17 Direct effect of environmental external factors, internal organisational factors and entrepreneurship support mechanisms on Entrepreneurial University's results

Taking all the measures and threshold values for the assessment of the measurement model into account, the measurement model was assessed. Regarding composite reliability and AVE values, results showed that all values were above the suggested threshold values. The table below (see Table 67) depicted all composite reliability and AVE values. Concerning factor loadings, results showed that except for ASO (0,6312), CONSULTING (0,6003), IND_MOBILITY (0,688), PATENT_LICENSE (0,6024), PR_RESEARCH (0,5649) and E_STAFF (0,6662) all values exceed the suggested threshold of 0,70 (Henseler et al., 2009, Hair et al., 2011). Even though factor loadings for these items did not meet the threshold value, according to Hair et al. (2011) these items should be retained if the composite reliability of the associated factor was above the threshold value of 0,70. Consequently, since the composite reliability value for ACADEMIC ENTREPRENEURSHIP ACTIVITIES (0,8946) and ENTREPRENEURSHIP SUPPORT MECHANISMS (0,9132) were above the threshold value of 0,60, the five items were retained. A table including all outer factor loadings is provided in Annexe E.

Table 67 Composite Reliability and AVE Values

Construct	Composite Reliability	AVE Value
EXTERNAL ENVIRONMENT	0,8908	0,8031
INTENRAL ORGANISATION	0,9027	0,7561
ACADEMIC ENTREPRENEURSHIP ACTIVITIES	0,8946	0,4905
ENTREPRENEURSHIP SUPPORT MECHANISMS	0,9132	0,5687

After establishing convergent validity, discriminant validity was assessed based on the Fornell-Larcker criterion (Fornell and Larcker, 1981) as described earlier. Results showed that for all constructs AVE values were higher than the construct's highest squared correlation with any other latent construct. Consequently, discriminant validity on the construct level was established (Henseler et al., 2009). A table including all squared latent variable correlations could be found in Annexe E.

Following the positive assessment of the outer model, that is, all latent variable scores of the outer path model showing adequate evidence of reliability and validity, in the next step the inner model was estimated. The first criterion that was examined was R^2 of endogenous latent variables (Henseler et al., 2009, Hair et al., 2011). Results showed that this value was near the level of 0,67 (substantial); thus, based on R^2 of the endogenous latent variable it could be concluded that the model predicted future outcomes quite well. The following table (see Table 68) showed the R^2 value.

Table 68 Coefficients of determination (R^2)

Construct (abbreviation)	R^2
ACADEMIC ENTREPRENEURSHIP ACTIVITIES	0,6266

In a next step, the confidence intervals of the path coefficient were determined by means of a bootstrapping procedure. Based on the bootstrap sample, the estimated coefficients could then be estimated in PLS-SEM for their significance (Hair et al., 2011).

The following settings for the bootstrap procedure were used: firstly, the number of cases was set to the number of original cases available in the data set (n = 69) (Hair et al., 2011). Next, the number of bootstrap samples was set to 5.000 as suggested by Henseler et al. (2009) and Hair et al. (2011). Finally, with regard to the option of sign changes that was available in SmartPLS when producing bootstrap samples, 'construct level changes' was selected based on the recommendation made by Tenenhaus et al. (2005).

Based on a significance level below p<0,10 (or *t*-statistics above 1,65), Table 69 shows relationships between environmental external factors, internal organisational factors, entrepreneurship support mechanisms and Entrepreneurial University's results. On closer inspection, the results indicated that, out of the three possible relationships there was a single significant relationships. Furthermore, according to Chin and Newsted (1999), path coefficients should range between 0,20 and 0,30, which explains 50% or more of the variance in the latent variable or model and in this case the single significant path coefficients was above 0,20.

Table 69 Results of Path Coefficients

Path	Path Coefficient (significance)
EXTERNAL ENVIRONMENT -> ACADEMIC ENTREPRENEURSHIP ACTIVITIES	0,1096
INTERNAL ORGANISATION -> ACADEMIC ENTREPRENEURSHIP ACTIVITIES	0,2658
ENTREPRENEURSHIP SUPPORT MECHANISMS -> ACADEMIC ENTREPRENEURSHIP ACTIVITIES	0,4665*

Afterwards, predictive relevance was examined as the final criterion of the assessment of the structural model. Predictive relevance could be measured by the Stone-Geisser criterion (onwards, Q^2), which refers to whether the model was able to predict the endogenous latent constructs' indicators (Henseler et al., 2009, Hair et al., 2011). In order to obtain Q^2 values, a blindfolding procedure was applied (Hair et al., 2011). Results showed that all Q^2 values were larger than 0,35, thus indicating a large predictive relevance. The following table (see Table 70) presents the predictive relevance Q^2 values.

Table 70 Predictive Relevance (Q^2) Values

Construct	SSO	SSE	Q^2 Values
EXTERNAL ENVIRONMENT	138	86,7312	0,3715
INTERNAL ORGANISATION	207	105,1304	0,4921
ACADEMIC ENTREPRENEURSHIP ACTIVITIES	621	411,6589	0,3371
ENTREPRENEURSHIP SUPPORT MECHANISMS	552	318,9331	0,4222

Finally, changes in R^2 were explored to investigate the impact of ENTREPRENEURSHIP SUPPORT MECHANISMS on ACADEMIC ENTREPRENEURSHIP ACTIVITIES. This was achieved by means of a repeated PLS-SEM process, which estimates and calculates the effect size in which one dimension is excluded in each of the PLS-SEM runs. It was suggested that $f^2 < 0,02$ = practically no effect, $0,02 \leq f^2 < 0,15$ = small effect, $0,15 \leq f^2 < 0,35$ = moderate effect, and $f^2 \geq 0,35$ = large effect (Elias, 2011). The effect size was calculated using the following formula:

$$Effect\ Size,\ f^2 = \frac{R^2_{included} - R^2_{excluded}}{1 - R^2_{included}}$$

ENTREPRENEURSHIP SUPPORT MECHANISMS had a significant positive effect on ACADEMIC ENTREPRENEURSHIP ACTIVITIES. In other words, the coefficient of the path from ENTREPRENEURSHIP SUPPORT MECHANISMS to ACADEMIC ENTREPRENEURSHIP ACTIVITIES was significant with a small effect size (β = 0,4665, $p < 0,05$, $f^2 = 0,0953$).

5.3.2   Indirect impact on Entrepreneurial University's results

As it was shown until this point, entrepreneurship support mechanisms were the only factors that had a significant influence on Entrepreneurial University's results or academic entrepreneurship activities. However, based on the literature review, both external environmental and internal organisational factors were really important on an Entrepreneurial University (Rasmussen et al., 2012). Indeed,

external environment is intended to include those forces and elements external to universities' boundaries that affect the organisation (Covin and Slevin, 1991) and internal organisational factors contribute significantly in enabling and stimulating the level of academic entrepreneurship in academic organisations (Etzkowitz, 2003c, Brennan et al., 2005, Brennan and McGowan, 2006, Clarysse et al., 2011, Yusof et al., 2012).

From this basis, the second model to be tested (see Figure 18) was the one which showed an integrative vision of the links between external environmental factors, internal organisational factors, entrepreneurship support mechanisms and Entrepreneurial University's results.
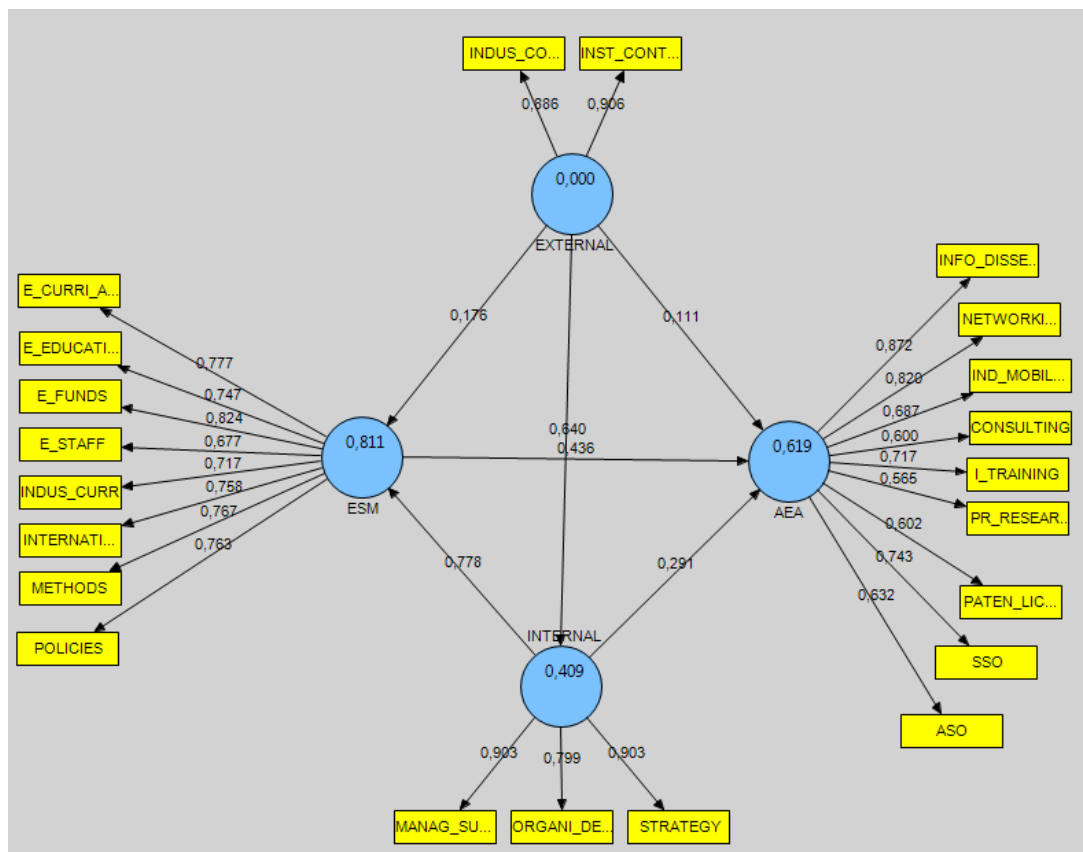
Figure 18 Indirect effect of environmental external factors, internal organisational factors and entrepreneurship support mechanisms on Entrepreneurial University's results

Taking all the measures and threshold values for the assessment of the measurement model into account, the measurement model was assessed. Regarding composite reliability and AVE values, results showed that all values were above the suggested threshold values. The table below (see Table 71) depicts all composite reliability and AVE values. Concerning factor loadings, results showed that except for ASO (0,6322), CONSULTING (0,6003), IND_MOBILITY (0,687), PATENT_LICENSE (0,6023), PR_RESEARCH (0,565) and E_STAFF (0,6771) all values exceed the suggested threshold of 0,70 (Henseler et al., 2009, Hair et al., 2011). Even though factor loadings for these items did not meet the threshold value, according to Hair et al. (2011) these items should be retained if the composite reliability of the associated factor was above the threshold value of 0,70.

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Consequently, since the composite reliability value for ACADEMIC ENTREPRENEURSHIP ACTIVITIES (0,8946) and ENTREPRENEURSHIP SUPPORT MECHANISMS (0,9136) were above the threshold value of 0,60, the five items were retained. A table including all outer factor loadings is provided in Annexe E.

Table 71 Composite Reliability and AVE Values

Construct	Composite Reliability	AVE Value
EXTERNAL ENVIRONMENT	0,8907	0,803
INTENRAL ORGANISATION	0,9027	0,7562
ACADEMIC ENTREPRENEURSHIP ACTIVITIES	0,8946	0,4904
ENTREPRENEURSHIP SUPPORT MECHANISMS	0,9136	0,57

After establishing convergent validity, discriminant validity was assessed based on the Fornell-Larcker criterion as described earlier. Results show that for all constructs AVE values were higher than the construct's highest squared correlation with any other latent construct. Consequently, discriminant validity on the construct level was established (Henseler et al., 2009). A table including all squared latent variable correlations could be found in Annexe E.

Following the positive assessment of the outer model, that is, all latent variable scores of the outer path model showing adequate evidence of reliability and validity, in the next step the inner model was estimated. The first criterion that was examined is R^2 of endogenous latent variables (Henseler et al., 2009, Hair et al., 2011). Results showed that this value was near the level of 0,67 (substantial); thus, based on R^2 of the endogenous latent variable it could be concluded that the model predicts future outcomes quite well. Table 72 shows the R^2 value.

Table 72 Coefficients of determination (R^2)

Construct (abbreviation)	R^2
INTERNAL ORGANISATION	0,4091
ACADEMIC ENTREPRENEURSHIP ACTIVITIES	0,6195
ENTREPRENEURSHIP SUPPORT MECHANISMS	0,8109

In a next step, the confidence intervals of the path coefficient were determined by means of a bootstrapping procedure. Based on the bootstrap sample, the estimated coefficients could then be estimated in PLS-SEM for their significance (Hair et al., 2011). The following settings for the bootstrap procedure in SmartPLS were used: firstly, the number of cases was set to the number of original cases available in the data set (n = 69) (Hair et al., 2011). Next, the number of bootstrap samples was set to 5,000 as suggested by Henseler et al. (2009) and Hair et al. (2011). Finally, with regard to the option of sign changes that is available in SmartPLS when producing bootstrap samples, 'construct level changes' was selected based on the recommendation made by Tenenhaus et al. (2005).

Based on a significance level below p<0,10, Table 73 shows significant relationships between environmental external factors, internal organisational factors, entrepreneurship support mechanisms and academic entrepreneurship activities. On closer inspection, the results indicated that, out of the six possible relationships there were five significant relationships. Furthermore, according to Chin and Newsted (1999), path coefficients should range between 0,20 and 0,30,

which explains 50% or more of the variance in the latent variable or model and in this case the single significant path coefficients is above 0,20.

Table 73 Results of Path Coefficients

Path	Path Coefficient (significance)
EXTERNAL ENVIRONMENT -> INTERNAL ORGANISATION	0,6396***
EXTERNAL ENVIRONMENT -> ACADEMIC ENTREPRENEURSHIP ACTIVITIES	0,1114
EXTERNAL ENVIRONMENT -> ENTREPRENEURSHIP SUPPORT MECHANISMS	0,1762*
INTERNAL ORGANISATION -> ACADEMIC ENTREPRENEURSHIP ACTIVITIES	0,2908+
INTERNAL ORGANISATION -> ENTREPRENEURSHIP SUPPORT MECHANISMS	0,7775***
ENTREPRENEURSHIP SUPPORT MECHANISMS -> ACADEMIC ENTREPRENEURSHIP ACTIVITIES	0,4358*

Afterwards, predictive relevance was examined as the final criterion of the assessment of the structural model. Predictive relevance could be measured by the Stone-Geisser criterion (Q^2), which refers to whether the model was able to predict the endogenous latent constructs' indicators (Henseler et al., 2009, Hair et al., 2011). In order to obtain Q^2 values, a blindfolding procedure was applied in SmartPLS (Hair et al., 2011). Results show that all Q^2 values are larger than 0,15, thus indicating a medium predictive relevance. The following table (see Table 74) presents the predictive relevance Q^2 values.

Table 74 Predictive Relevance (Q^2) Values

Construct	SSO	SSE	Q^2 Values
INTERNAL ORGANISATION	207	145.8451	0.2954
ACADEMIC ENTREPRENEURSHIP ACTIVITIES	621	456.2378	0.2653
ENTREPRENEURSHIP SUPPORT MECHANISMS	552	313.2258	0.4326

Finally, changes in R^2 were explored to investigate the impact of ENTREPRENEURSHIP SUPPORT MECHANISMS on ACADEMIC ENTREPRENEURSHIP ACTIVITIES. This was achieved using the same procedure as in the previous model (see Section 5.3.1).

EXTERNAL ENVIRONMENT had a strongly significant positive effect on INTERNAL ORGANISATION. In other words, the coefficient of the path from EXTERNAL ENVIRONMENT to INTERNAL ORGANISATION was strongly significant with a large effect size ($\beta = 0,6396$, $p < 0,001$, $f^2 = 0,6923$), as was the coefficient of the path from EXTERNAL ENVIRONMENT to ENTREPRENEURSHIP SUPPORT MECHANISMS which was significant with a small effect size ($\beta = 0,1762$, $p < 0,05$, $f^2 = 0,0957$). Also, INTERNAL ORGANISATION was found to be a significant predictor of ACADEMIC ENTREPRENEURSHIP ACTIVITIES with a with a small effect size ($\beta = 0,2908$, $p < 0,1$, $f^2 = 0,0478$). Moreover, INTERNAL ORGANISATION had a strongly significant positive effect on ENTREPRENEURSHIP SUPPORT MECHANISMS, the path was strongly significant with a large effect size ($\beta = 0,7775$, $p < 0,001$, $f^2 = 1,108$). Finally, regarding ENTREPRENEURSHIP SUPPORT MECHANISMS, the path coefficient from ACADEMIC ENTREPRENEURSHIP ACTIVITIES to ENTREPRENEURSHIP SUPPORT MECHANISMS was significant with a small effect size ($\beta = 0,4358$, $p < 0,05$, $f^2 = 0,0814$).

5.3.2.1 The effect of external environmental factors on entrepreneurship support mechanisms

As indicated in the previous sections, external environmental factors did not have a direct influence on Entrepreneurial University's results; however the second model tested showed that in an indirect way, through internal organisational factors and entrepreneurship support mechanisms, their presence was important. Due to this fact, it was necessary to analyse the effect of the external environment on entrepreneurship support mechanisms. Furthermore, as the external environment was measured by institutional and industrial context it was interesting to analyse both separately. The analysis of these relationships was performed using a *t*-test which follows a Student's *t* distribution if the null hypothesis was supported; since it allowed determining if two sets of data were significantly different from each other.

Institutional Context

It is supposed that the universities that obtain more support from their nearest institutions promote more entrepreneurship support mechanisms, since a supportive local context is essential or the path towards the Entrepreneurial University. Thus, in order to analyse whether these differences are significant and contrast the hypothesis, the Student's *t*-test has been performed (see Table 75).

Table 75 Student's *t*-test for independent samples applied to entrepreneurship support mechanisms in relation to INST_CONTEXT

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
POLICIES									
Equal variances assumed	11,271	0,001	4,029	67	0,000	0,86034	0,21354	0,43412	1,28657
Equal variances not assumed			4,309	66,174	0,000	0,86034	0,19964	0,46176	1,25893
INDUS_CURRI									
Equal variances assumed	0,799	0,375	2,508	67	0,015	0,44448	0,17724	0,09072	0,79825
Equal variances not assumed			2,609	66,604	0,011	0,44448	0,17037	0,10438	0,78458
INTERNATION.									
Equal variances assumed	0,411	0,524	1,986	67	0,051	0,39698	0,19991	-0,00204	0,796
Equal variances not assumed			2,035	64,997	0,046	0,39698	0,1951	0,00735	0,78662
E_FUNDS									
Equal variances assumed	4,934	0,03	4,148	67	0,000	0,81399	0,19624	0,42229	1,2057
Equal variances not assumed			3,894	45,362	0,000	0,81399	0,20905	0,39303	1,23495
E_EDUCATION									
Equal variances assumed	0,048	0,828	2,683	67	0,009	0,56848	0,2119	0,14554	0,99143
Equal variances not assumed			2,69	61,068	0,009	0,56848	0,21133	0,14591	0,99105
METHODS									
Equal variances assumed	0,467	0,497	3,068	67	0,003	0,57897	0,18874	0,20224	0,9557
Equal variances not assumed			3,172	66,088	0,002	0,57897	0,18255	0,21451	0,94344
E_CURRI_ACTIVITIES									
Equal variances assumed	0,354	0,554	3,925	67	0,000	0,80586	0,20533	0,39602	1,2157
Equal variances not assumed			4,02	64,956	0,000	0,80586	0,20045	0,40554	1,20618
E_STAFF									
Equal variances assumed	0,584	0,448	2,906	67	0,005	0,67402	0,23196	0,21102	1,13701
Equal variances not assumed			2,862	56,964	0,006	0,67402	0,23552	0,20238	1,14565

Note that the Levene statistic had an associated p-value greater than the critical significance level of 0,05, thus the assumption of equal variances (the property holds homoscedasticity of variance) was assumed in all cases (except two). Moreover, the statistical t value was less than the critical value of 0,05 for all entrepreneurship support mechanisms, rejecting the null hypothesis of equal means. Thus it could be concluded that universities which had a higher institutional support promote more entrepreneurship support mechanisms (see Table 76).

Table 76 Means of entrepreneurship support mechanisms in relation to INST_CONTEXT

	INST_CONTEXT	N	Mean	Std. Deviation	Std. Error Mean
POLICIES	>= 3,11	29	3,9603	,64757	,12025
	< 3,11	40	3,1000	1,00792	,15937
INDUS_CURRI	>= 3,11	29	3,2545	,61951	,11504
	< 3,11	40	2,8100	,79479	,12567
INTERNATIONALISATION	>= 3,11	29	3,5145	,74624	,13857
	< 3,11	40	3,1175	,86856	,13733
E_FUNDS	>= 3,11	29	2,8972	,98050	,18207
	< 3,11	40	2,0833	,64966	,10272
E_EDUCATION	>= 3,11	29	3,3445	,86044	,15978
	< 3,11	40	2,7760	,87478	,13831
METHODS	>= 3,11	29	3,3717	,67813	,12593
	< 3,11	40	2,7928	,83588	,13216
E_CURRI_ACTIVITIES	>= 3,11	29	3,8059	,76739	,14250
	< 3,11	40	3,0000	,89156	,14097
E_STAFF	>= 3,11	29	2,8155	1,00265	,18619
	< 3,11	40	2,1415	,91227	,14424

Industrial Context

It was supposed that the universities that obtain more support from their nearest industry promote more entrepreneurship support mechanisms, since the closer interaction between companies helps to create a social environment that supports and encourages individuals to share knowledge and ideas. Thus, in order to analyse whether these differences are significant and contrast the hypothesis, the t-test was performed. The results are shown in Table 77 and Table 78.

Table 77 Student's t-test for independent samples applied to entrepreneurship support mechanisms in relation to INDUS_CONTEXT

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
POLICIES									
Equal variances assumed	1,085	0,301	2,635	67	0,01	0,58945	0,22368	0,14298	1,03591
Equal variances not assumed			2,64	66,553	0,01	0,58945	0,22332	0,14365	1,03524
INDUS_CURRI									
Equal variances assumed	0,23	0,633	3,636	67	0,001	0,60815	0,16726	0,27431	0,942
Equal variances not assumed			3,638	67	0,001	0,60815	0,16718	0,27446	0,94184
INTERNATION.									
Equal variances assumed	2,312	0,133	5,128	67	0,000	0,88263	0,17211	0,5391	1,22616
Equal variances not assumed			5,117	64,882	0,000	0,88263	0,17249	0,53813	1,22713
E_FUNDS									
Equal variances assumed	7,492	0,008	2,076	67	0,042	0,43706	0,21055	0,01681	0,85731
Equal variances not assumed			2,061	52,686	0,044	0,43706	0,21209	0,01161	0,86251

Table 78 Student's *t*-test for independent samples applied to entrepreneurship support mechanisms in relation to INDUS_CONTEXT (continuation)

	Levene's Test for Equality of Variances		t-test for Equality of Means						
								95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
E_EDUCATION									
Equal variances assumed	5,435	0,023	3,258	67	0,002	0,66637	0,20455	0,25808	1,07466
Equal variances not assumed			3,246	62,377	0,002	0,66637	0,20529	0,25605	1,07669
METHODS									
Equal variances assumed	2,289	0,135	4,237	67	0,000	0,74874	0,17673	0,39598	1,1015
Equal variances not assumed			4,225	63,927	0,000	0,74874	0,17723	0,39467	1,1028
E_CURRI_ACTIVITIES									
Equal variances assumed	0,001	0,976	1,102	67	0,274	0,24552	0,22282	-0,19922	0,69026
Equal variances not assumed			1,1	65,891	0,275	0,24552	0,22314	-0,20002	0,69106
E_STAFF									
Equal variances assumed	0,058	0,81	2,019	67	0,047	0,47647	0,23595	0,00552	0,94742
Equal variances not assumed			2,019	66,805	0,048	0,47647	0,23603	0,00532	0,94762

Note that the Levene statistic had an associated p-value greater than the critical significance level of 0,05, thus the assumption of equal variances was assumed in all cases (except two). Moreover, the statistical *t* value was less than the critical value of 0,05 for all entrepreneurship support mechanisms, except for E_CURRI_ACTIVITIES. Thus, it could be concluded that universities which had a higher industrial support promote more entrepreneurship support mechanisms, except E_CURRI_ACTIVITIES (see Table 79).

Table 79 Means of entrepreneurship support mechanisms in relation to INDUS_CONTEXT

	INDUS_CONTEXT	N	Mean	Std. Deviation	Std. Error Mean
POLICIES	>= 3,08	34	3,7606	,87503	,15007
	< 3,08	35	3,1711	,97839	,16538
INDUS_CURRI	>= 3,08	34	3,3053	,68347	,11721
	< 3,08	35	2,6971	,70523	,11921
INTERNATIONALISATION	>= 3,08	34	3,7321	,76788	,13169
	< 3,08	35	2,8494	,65909	,11141
E_FUNDS	>= 3,08	34	2,6471	1,07322	,18406
	< 3,08	35	2,2100	,62342	,10538
E_EDUCATION	>= 3,08	34	3,3529	,94908	,16277
	< 3,08	35	2,6866	,74012	,12510
METHODS	>= 3,08	34	3,4159	,80191	,13753
	< 3,08	35	2,6671	,66136	,11179
E_CURRI_ACTIVITIES	>= 3,08	34	3,4632	,97143	,16660
	< 3,08	35	3,2177	,87826	,14845
E_STAFF	>= 3,08	34	2,6665	,99203	,17013
	< 3,08	35	2,1900	,96790	,16360

5.3.2.2 The effect of internal organisational factors on entrepreneurship support mechanisms

As indicated in the previous sections, internal organisational factors did not have a direct influence on Entrepreneurial University's results; however the second model tested showed that in an indirect way, through entrepreneurship support mechanisms, their presence was important. Due to this fact, it was necessary to analyse the effect of internal organisational factors on entrepreneurship support mechanisms. Furthermore, as the internal organisation was measured by strategy,

organisational design and management support level it was interesting to analyse these three separately.

The analysis of these relationships was performed using a *t*-test which followed a Student's *t* distribution if the null hypothesis was supported; since it allowed determining if two sets of data were significantly different from each other.

Strategy

It was supposed that universities that embraced strategies regarding the third mission develop their agenda further as the higher education landscape continues to change and to gain wider recognition locally, nationally and globally as an Entrepreneurial University (Coyle et al., 2013). Thus, in order to analyse whether these differences were significant and contrast the hypothesis, the Student's *t*-test was performed. The results are shown in Table 80.

Table 80 Student's *t*-test for independent samples applied to entrepreneurship support mechanisms in relation to STRATEGY

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
POLICIES									
Equal variances assumed	2,984	0,089	4,36	67	0,000	0,90505	0,20757	0,49074	1,31937
Equal variances not assumed			4,322	61,883	0,000	0,90505	0,20942	0,4864	1,3237
INDUS_CURRI									
Equal variances assumed	0,68	0,413	3,651	67	0,001	0,61071	0,16729	0,2768	0,94461
Equal variances not assumed			3,658	66,891	0,001	0,61071	0,16693	0,2775	0,94392
INTERNATION.									
Equal variances assumed	1,521	0,222	3,201	67	0,002	0,60598	0,18931	0,22813	0,98384
Equal variances not assumed			3,215	66,995	0,002	0,60598	0,1885	0,22974	0,98223
E_FUNDS									
Equal variances assumed	11,083	0,001	5,173	67	0,000	0,95061	0,18377	0,58379	1,31742
Equal variances not assumed			5,302	54,304	0,000	0,95061	0,1793	0,59117	1,31004
E_EDUCATION									
Equal variances assumed	7,169	0,009	5,888	67	0,000	1,05316	0,17888	0,69612	1,4102
Equal variances not assumed			5,985	61,798	0,000	1,05316	0,17596	0,70139	1,40492
METHODS									
Equal variances assumed	0,003	0,959	6,318	67	0,000	0,99614	0,15767	0,68143	1,31084
Equal variances not assumed			6,303	65,661	0,000	0,99614	0,15805	0,68055	1,31172
E_CURRI_ACTIVITIES									
Equal variances assumed	0,945	0,335	3,913	67	0,000	0,79437	0,20301	0,38916	1,19958
Equal variances not assumed			3,887	63,405	0,000	0,79437	0,20437	0,38603	1,20271
E_STAFF									
Equal variances assumed	0,013	0,909	3,167	67	0,002	0,71833	0,22684	0,26556	1,17111
Equal variances not assumed			3,161	65,897	0,002	0,71833	0,22725	0,26459	1,17207

Note that the Levene statistic had an associated p-value greater than the critical significance level of 0,05, thus the assumption of equal variances (the property holds homoscedasticity of variance) was assume in all cases (except two). Moreover, the statistical *t* value is less than the critical value of 0,05 for all entrepreneurship support mechanisms, rejecting the null hypothesis of equal means. Thus it could be concluded that universities which had an established strategy for fostering universities third mission promote more entrepreneurship support mechanisms (see Table 81).

Table 81 Means of entrepreneurship support mechanisms in relation to STRATEGY

	STRATEGY	N	Mean	Std. Deviation	Std. Error Mean
POLICIES	>= 3,38	36	3,8944	,77332	,12889
	< 3,38	33	2,9894	,94822	,16506
INDUS_CURRI	>= 3,38	36	3,2889	,70984	,11831
	< 3,38	33	2,6782	,67654	,11777
INTERNATIONALISATION	>= 3,38	36	3,5742	,82094	,13682
	< 3,38	33	2,9682	,74483	,12966
E_FUNDS	>= 3,38	36	2,8800	,94027	,15671
	< 3,38	33	1,9294	,50048	,08712
E_EDUCATION	>= 3,38	36	3,5186	,86245	,14374
	< 3,38	33	2,4655	,58303	,10149
METHODS	>= 3,38	36	3,5125	,63688	,10615
	< 3,38	33	2,5164	,67267	,11710
E_CURRI_ACTIVITIES	>= 3,38	36	3,7186	,77885	,12981
	< 3,38	33	2,9242	,90676	,15785
E_STAFF	>= 3,38	36	2,7683	,92254	,15376
	< 3,38	33	2,0500	,96130	,16734

Organisational design

It was supposed that the universities that had a contemporary organisational design promote more entrepreneurship support mechanisms, since the organisational design of a university fosters the entrepreneurial behaviour within it. Thus, in order to analyse whether these differences were significant and contrast the hypothesis, the Student's t-test was performed. The results are shown in Table 82.

Table 82 Student's *t*-test for independent samples applied to Entrepreneurship Support Mechanisms in relation to ORGANI_DESIGN

	Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
POLICIES									
Equal variances assumed	2,287	0,135	3,378	67	0,001	0,74316	0,22001	0,30403	1,1823
Equal variances not assumed			3,473	65,465	0,001	0,74316	0,21396	0,31591	1,17042
INDUS_CURRI									
Equal variances assumed	0,206	0,652	4,502	67	0,000	0,73119	0,16242	0,40699	1,05539
Equal variances not assumed			4,477	59,271	0,000	0,73119	0,16331	0,40444	1,05794
INTERNATION.									
Equal variances assumed	1,933	0,169	4,2	67	0,000	0,76875	0,18302	0,40345	1,13405
Equal variances not assumed			4,115	55,676	0,000	0,76875	0,18682	0,39446	1,14304
E_FUNDS									
Equal variances assumed	5,129	0,027	2,976	67	0,004	0,61532	0,20676	0,20262	1,02802
Equal variances not assumed			2,79	45,079	0,008	0,61532	0,22053	0,17117	1,05946
E_EDUCATION									
Equal variances assumed	3,279	0,075	2,587	67	0,012	0,55004	0,21262	0,12565	0,97444
Equal variances not assumed			2,504	52,73	0,015	0,55004	0,21965	0,10944	0,99065
METHODS									
Equal variances assumed	1,109	0,296	4,188	67	0,000	0,75147	0,17944	0,39331	1,10963
Equal variances not assumed			4,041	51,951	0,000	0,75147	0,18595	0,37832	1,12462
E_CURRI_ACTIVITIES									
Equal variances assumed	0	0,997	2,694	67	0,009	0,5828	0,2163	0,15107	1,01453
Equal variances not assumed			2,71	61,72	0,009	0,5828	0,21505	0,15289	1,01271
E_STAFF									
Equal variances assumed	0,537	0,466	1,729	67	0,088	0,41646	0,24083	-0,06424	0,89715
Equal variances not assumed			1,709	57,83	0,093	0,41646	0,24364	-0,07128	0,90419

Note that the Levene statistic had an associated p-value greater than the critical significance level of 0,05, thus the assumption of equal variances (the property holds homoscedasticity of variance) was assumed in all cases (except one). Moreover, the statistical *t* value was less than the critical value of 0,05 for all entrepreneurship support mechanisms, except for E_STAFF. Thus it could be concluded that universities which had a Contemporary Organisational design promote more entrepreneurship support mechanisms, except E_STAFF (see Table 83).

Table 83 Means of entrepreneurship support mechanisms in relation to ORGANI_DESIGN

	ORGANI_DESIGN	N	Mean	Std. Deviation	Std. Error Mean
POLICIES	>= 3,04	29	3,8924	,80938	,15030
	< 3,04	40	3,1492	,96314	,15229
INDUS_CURRI	>= 3,04	29	3,4207	,67896	,12608
	< 3,04	40	2,6895	,65649	,10380
INTERNATIONAL.	>= 3,04	29	3,7300	,80505	,14949
	< 3,04	40	2,9613	,70858	,11204
E_FUNDS	>= 3,04	29	2,7821	1,03656	,19249
	< 3,04	40	2,1668	,68064	,10762
E_EDUCATION	>= 3,04	29	3,3338	,97142	,18039
	< 3,04	40	2,7838	,79257	,12532
METHODS	>= 3,04	29	3,4717	,82781	,15372
	< 3,04	40	2,7203	,66177	,10464
E_CURRI_ACTIVITIES	>= 3,04	29	3,6766	,86830	,16124
	< 3,04	40	3,0938	,89994	,14229
E_STAFF	>= 3,04	29	2,6662	1,02837	,19096
	< 3,04	40	2,2497	,95698	,15131

Management team support

It was supposed that the universities that have management support promote more entrepreneurship support mechanisms, since dynamic management structure was essential for an institutional transformation of the university towards the Entrepreneurial University. Thus, in order to analyse whether these differences were significant and contrast the hypothesis, the Student's t-test was performed. The results are shown in Table 84 and Table 85.

Table 84 Student's *t*-test for independent samples applied to entrepreneurship support mechanisms in relation to MANAG_SUPPORT

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
POLICIES									
Equal variances assumed	3,394	0,07	4,786	67	0,000	0,97581	0,20389	0,56885	1,3827
Equal variances not assumed			4,692	57,948	0,000	0,97581	0,20798	0,55949	1,3921
INDUS_CURRI									
Equal variances assumed	0,353	0,554	2,644	67	0,01	0,4628	0,17504	0,11342	0,81218
Equal variances not assumed			2,658	65,405	0,01	0,4628	0,17413	0,11509	0,81052
INTERNATION.									
Equal variances assumed	0,895	0,347	3,744	67	0,000	0,69497	0,18564	0,32444	1,0655
Equal variances not assumed			3,757	65,054	0,000	0,69497	0,18498	0,32553	1,0644

Table 85 Student's *t*-test for independent samples applied to entrepreneurship support mechanisms in relation to MANAG_SUPPORT (continuation)

	Levene's Test for Equality of Variances		t-test for Equality of Means							
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference		
								Lower	Upper	
E_FUNDS										
Equal variances assumed	11,521	0,001	5,27	67	0,000	0,96742	0,18356	0,60104	1,3338	
Equal variances not assumed			5,603	56,894	0,000	0,96742	0,17267	0,62164	1,3132	
E_EDUCATION										
Equal variances assumed	0,327	0,569	3,951	67	0,000	0,78739	0,19927	0,38964	1,1851	
Equal variances not assumed			3,966	65,076	0,000	0,78739	0,19855	0,39086	1,1839	
METHODS										
Equal variances assumed	0,51	0,478	3,796	67	0,000	0,68875	0,18145	0,32657	1,0509	
Equal variances not assumed			3,699	55,722	0,000	0,68875	0,18619	0,31572	1,0617	
E_CURRI_ACTIVITIES										
Equal variances assumed	0,192	0,663	3,445	67	0,001	0,7175	0,20827	0,30179	1,1332	
Equal variances not assumed			3,42	62,229	0,001	0,7175	0,20979	0,29816	1,1368	
E_STAFF										
Equal variances assumed	0,098	0,755	3,53	67	0,001	0,79182	0,22428	0,34415	1,2394	
Equal variances not assumed			3,557	65,841	0,001	0,79182	0,22258	0,34741	1,2362	

The Levene statistic had an associated p-value greater than the critical significance level of 0,05, thus the assumption of equal variances (the property holds homoscedasticity of variance) was assumed in all cases (except two). Moreover, the statistical *t* value was less than the critical value of 0,05 for all entrepreneurship support mechanisms, rejecting the null hypothesis of equal means. Thus, universities which had their management team support promote more entrepreneurship support mechanisms (see Table 86).

Table 86 Means of entrepreneurship support mechanisms in relation to MANAG_SUPPORT

	MANAG_SUPPORT	N	Mean	Std. Deviation	Std. Error Mean
POLICIES	>= 3,19	38	3,9000	,76462	,12404
	< 3,19	31	2,9242	,92947	,16694
INDUS_CURRI	>= 3,19	38	3,2047	,73946	,11996
	< 3,19	31	2,7419	,70274	,12622
INTERNATIONALISATION	>= 3,19	38	3,5966	,77862	,12631
	< 3,19	31	2,9016	,75247	,13515
E_FUNDS	>= 3,19	38	2,8600	,92904	,15071
	< 3,19	31	1,8926	,46920	,08427
E_EDUCATION	>= 3,19	38	3,3687	,83619	,13565
	< 3,19	31	2,5813	,80730	,14500
METHODS	>= 3,19	38	3,3455	,65787	,10672
	< 3,19	31	2,6568	,84948	,15257
E_CURRI_ACTIVITIES	>= 3,19	38	3,6611	,83267	,13508
	< 3,19	31	2,9435	,89375	,16052
E_STAFF	>= 3,19	38	2,7805	,95677	,15521
	< 3,19	31	1,9887	,88825	,15953

5.4 ANALYSING THE EFFECT OF ENTREPRENEURSHIP SUPPORT MECHANISMS ON ENTREPRENEURIAL UNIVERSITY'S RESULTS

As indicated in the previous sections, entrepreneurship support mechanisms are the factors which have a higher influence on Entrepreneurial University's results. Bearing this in mind and in order to achieve the third specific objective of the research, concretely to analyse the impact of entrepreneurship support mechanisms on Entrepreneurial University's results, diverse statistical techniques were applied.

In order to achieve this objective a *k*-means cluster analysis was performed; based on Entrepreneurial University's results. Specifically, the objective of the cluster analysis was to assign observations to groups (or clusters) so that observations within each group were similar to one another with respect to variables or attributes of interest (for this specific case the Entrepreneurial University's results), and the groups themselves stand apart from one another (Tryfos, 1989). Regarding the clustering method, the *k*-means clustering was selected since already a hypothesis concerning the number of clusters was already established; two clusters. Consecutively a Student's *t*-test was applied to figure out if the null hypothesis was supported; since it allowed determining if two sets of data were significantly different from each other.

Through the *k*-means cluster analysis, the total amount of universities was divided into two groups due to their Entrepreneurial University's results. In particular, the fifty-seven universities that composed the first group were the ones that obtained better results on almost all Entrepreneurial University's results (except for PR_RESEARCH) and the rest twelve universities (the second group) were the ones that obtained worst values (see Table 87).

Table 87 *k*-means cluster based on Entrepreneurial University's results

	Cluster	
	1 (n=57)	*2 (n=12)*
INFO_DISSEMINATION	3,01	2,22
NETWORKING	3,44	2,39
I_TRAINING	3,28	1,92
IND_MOBILITY	2,64	2,06
CONSULTING	3,39	2,50
PR_RESEARCH	3,28	3,36
PATENT_LICENSE	2,73	1,83
ASO	2,66	2,02
SSO	2,87	2,04

Once this classification was done, the next step was to compare the means of both groups using the *t*-test (see Table 88).

Table 88 Student's *t*-test for independent samples applied to entrepreneurship support mechanisms in relation to the two clusters

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Differen ce	Std. Error Differen ce	95% Confidence Interval of the Difference Lower	Upper
POLICIES									
Equal variances assumed	0,939	0,336	5,805	67	0,000	1,46768	0,25282	0,96305	1,9723
Equal variances not assumed			6,637	18,705	0,000	1,46768	0,22113	1,00435	1,931
INDUS_CURRI									
Equal variances assumed	0,972	0,328	3,864	67	0,000	0,84351	0,2183	0,40778	1,27923
Equal variances not assumed			4,573	19,652	0,000	0,84351	0,18446	0,45829	1,22873
INTERNATION.									
Equal variances assumed	0,161	0,689	4,483	67	0,000	1,05338	0,23495	0,58441	1,52234
Equal variances not assumed			4,064	14,639	0,001	1,05338	0,25917	0,49977	1,60698
E_FUNDS									
Equal variances assumed	2,274	0,136	3,148	67	0,002	0,84175	0,26741	0,308	1,37551
Equal variances not assumed			3,856	20,739	0,001	0,84175	0,2183	0,38744	1,29607
E_EDUCATION									
Equal variances assumed	0,396	0,531	3,312	67	0,001	0,89167	0,26918	0,35437	1,42896
Equal variances not assumed			3,38	16,314	0,004	0,89167	0,2638	0,33331	1,45002
METHODS									
Equal variances assumed	1,089	0,3	3,204	67	0,002	0,78311	0,24443	0,29523	1,271
Equal variances not assumed			4,111	22,463	0,000	0,78311	0,19049	0,38853	1,1777
E_CURRI_ACTIVITIES									
Equal variances assumed	0,454	0,503	4	67	0,000	1,0657	0,26644	0,5339	1,59751
Equal variances not assumed			3,666	14,768	0,002	1,0657	0,29072	0,44519	1,68621
E_STAFF									
Equal variances assumed	0,226	0,636	3,321	67	0,001	0,98632	0,29703	0,39343	1,5792
Equal variances not assumed			3,042	14,762	0,008	0,98632	0,32426	0,29419	1,67844

Note that the Levene statistic had an associated p-value greater than the critical significance level of 0,05, thus the assumption of equal variances (the property holds homoscedasticity of variance) was assumed in all cases. Moreover, the statistical *t* value was less than the critical value of 0,05 for all entrepreneurship support mechanisms, rejecting the null hypothesis of equal means. Thus it could be concluded that universities which had better results on Entrepreneurial University's results (first group), promote in a higher level all entrepreneurship support mechanisms (see Table 89).

Table 89 Means of entrepreneurship support mechanisms in relation to both clusters

	Cluster Number of Case	N	Mean	Std. Deviation	Std. Error Mean
POLICIES	1	57	3,7168	,81887	,10846
	2	12	2,2492	,66754	,19270
INDUS_CURRI	1	57	3,1435	,71127	,09421
	2	12	2,3000	,54938	,15859
INTERNATIONALISATION	1	57	3,4675	,71958	,09531
	2	12	2,4142	,83489	,24101
E_FUNDS	1	57	2,5718	,87608	,11604
	2	12	1,7300	,64051	,18490
E_EDUCATION	1	57	3,1700	,85168	,11281
	2	12	2,2783	,82605	,23846
METHODS	1	57	3,1723	,80619	,10678
	2	12	2,3892	,54647	,15775
E_CURRI_ACTIVITIES	1	57	3,5240	,81880	,10845
	2	12	2,4583	,93440	,26974
E_STAFF	1	57	2,5963	,91270	,12089
	2	12	1,6100	1,04231	,30089

5.4.1 The impact of entrepreneurship support mechanisms on Hard AEA and Soft AEA

As it was shown in Section 2.2, Entrepreneurial University's results or academic entrepreneurship activities could be divided into two different types of activities, regarding their the potential of each activity to contribute to the economic and social development (Philpott et al., 2011). Concretely, these activities could be divided into hard or direct activities (Hard AEA), which are generally perceived to be more tangible outputs fostering the economic and social development directly; and into soft or indirect activities (Soft AEA), which are characterised by universities' close relationship with industry boosting the economic and social development in an indirect way (through industry). Thus, this classification was another variable included within the analysis.

Thereby, the influence of entrepreneurship support mechanisms on Hard AEA and Soft AEA separately is analysed within this section; since, from the previous analysis there were some evidence which showed the different behaviour of these two groups. The analysis of these relationships was performed using k-means cluster analysis and consecutively a t-test to figure out if the null hypothesis was supported; since it allowed determining if two sets of data were significantly different from each other.

Hard academic entrepreneurship activities (Hard AEA)

Through the k-means cluster analysis, the total amount of universities was divided into two groups based on their Hard AEAs' level. In particular, the fifty-two universities that composed the first group were the ones that obtained better results on Hard AEA and the rest seventeen were the ones that obtained worse values (see Table 90).

Table 90 *k*-means cluster based on Hard AEA

	Cluster	
	1 (n=52)	*2 (n=17)*
PATENT_LICENSE	2,81	1,84
ASO	2,75	1,94
SSO	2,96	2,01

First of all, it was interesting to analyse the real differences between both groups regarding Entrepreneurial University's results; in order to ratify if the first group only obtain better results in Hard AEA. Therefore a t-test was applied (see Table 91 and Table 92). This analysis shows that in addition to Hard AEA, universities from the first group also obtained better results on INFO_DISSEMINATION and NETWORKING.

Table 91 Student's *t*-test for independent samples applied to Entrepreneurial University's results in relation to the two clusters of Hard AEA

	Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
INFO_DISSEMIN.									
Equal variances assumed	1,697	,197	2,441	67	,017	,40850	,16735	,07446	,74253
Equal variances not assumed			2,089	21,930	,048	,40850	,19551	,00296	,81403
NETWORKING									
Equal variances assumed	2,727	,103	3,956	67	,000	,62320	,15752	,30880	,93760
Equal variances not assumed			3,360	21,731	,003	,62320	,18547	,23828	1,00813
I_TRAINING									
Equal variances assumed	19,23	,000	2,240	67	,028	,52602	,23480	,05735	,99469
Equal variances not assumed			1,637	18,792	,118	,52602	,32131	-,14700	1,19903
IND_MOBILITY									
Equal variances assumed	6,098	,016	1,548	67	,126	,26725	,17260	-,07725	,61176
Equal variances not assumed			1,306	21,569	,205	,26725	,20458	-,15751	,69201
CONSULTING									
Equal variances assumed	3,388	,070	1,019	67	,312	,22964	,22541	-,22028	,67956
Equal variances not assumed			,785	19,675	,442	,22964	,29247	-,38109	,84037
PR_RESEARCH									
Equal variances assumed	2,386	,127	-,159	67	,874	-,03265	,20472	-,44126	,37597
Equal variances not assumed			-,142	23,014	,888	-,03265	,22987	-,50816	,44287
PATENT_LICENSE									
Equal variances assumed	3,488	,066	8,225	67	,000	,96727	,11760	,73255	1,20200
Equal variances not assumed			7,109	22,180	,000	,96727	,13606	,68523	1,24932
ASO									
Equal variances assumed	3,415	,069	6,435	67	,000	,80498	,12509	,55531	1,05465
Equal variances not assumed			8,503	50,289	,000	,80498	,09466	,61486	,99509
SSO									
Equal variances assumed	1,479	,228	7,419	67	,000	,94683	,12763	,69209	1,20158
Equal variances not assumed			9,099	41,622	,000	,94683	,10406	,73678	1,15688

Table 92 Means of Entrepreneurial University's results in relation to the two clusters of Hard AEA

	Cluster Number of Case	N	Mean	Std. Deviation	Std. Error Mean
INFO_DISSEMINATION	1	52	2,9767	,54598	,07571
	2	17	2,5682	,74320	,18025
NETWORKING	1	52	3,4067	,51077	,07083
	2	17	2,7835	,70677	,17142
I_TRAINING	1	52	3,1731	,64841	,08992
	2	17	2,6471	1,27187	,30847
IND_MOBILITY	1	52	2,6002	,55675	,07721
	2	17	2,3329	,78112	,18945
CONSULTING	1	52	3,2885	,66676	,09246
	2	17	3,0588	1,14404	,27747
PR_RESEARCH	1	52	3,0450	,68699	,09527
	2	17	3,0776	,86257	,20920
PATENT_LICENSE	1	52	2,8090	,38644	,05359
	2	17	1,8418	,51566	,12507
ASO	1	52	2,7462	,49008	,06796
	2	17	1,9412	,27170	,06590
SSO	1	52	2,9615	,49106	,06810
	2	17	2,0147	,32441	,07868

Once this contract was done, the next step was to compare the means of both groups using the *t*-test (see Table 93). Note that the Levene statistic had an associated p-value greater than the critical significance level of 0,05, thus the assumption of equal variances (the property holds homoscedasticity of variance) was assumed in all cases.

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Table 93 Student's *t*-test for independent samples applied to entrepreneurship support mechanisms in relation to the two clusters of Hard AEA

| | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | | |
| | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | 95% Confidence Interval of the Difference | |
								Lower	Upper
POLICIES									
Equal variances assumed	0,947	0,334	4,392	67	0,000	1,05507	0,24025	0,57553	1,5346
Equal variances not assumed			4,073	24,297	0,000	1,05507	0,25903	0,52081	1,58933
INDUS_CURRI									
Equal variances assumed	0,284	0,596	1,786	67	0,079	0,37043	0,20746	-0,04367	0,78453
Equal variances not assumed			1,621	23,598	0,118	0,37043	0,22852	-0,10163	0,84249
INTERNATION.									
Equal variances assumed	0,454	0,503	3,672	67	0,000	0,78943	0,215	0,36029	1,21858
Equal variances not assumed			3,322	23,488	0,003	0,78943	0,23765	0,29837	1,2805
E_FUNDS									
Equal variances assumed	3,821	0,055	3,311	67	0,001	0,77361	0,23362	0,30729	1,23993
Equal variances not assumed			4,147	43,848	0,000	0,77361	0,18655	0,39761	1,14961
E_EDUCATION									
Equal variances assumed	0,185	0,669	2,651	67	0,01	0,64424	0,24301	0,15919	1,12929
Equal variances not assumed			2,508	24,993	0,019	0,64424	0,25689	0,11515	1,17333
METHODS									
Equal variances assumed	0,247	0,621	3,394	67	0,001	0,72383	0,21329	0,29811	1,14956
Equal variances not assumed			3,239	25,319	0,003	0,72383	0,2235	0,26382	1,18385
E_CURRI_ACTIVITIES									
Equal variances assumed	0	0,983	5,501	67	0,000	1,19094	0,2165	0,7588	1,62308
Equal variances not assumed			5,635	28,401	0,000	1,19094	0,21136	0,75827	1,62361
E_STAFF									
Equal variances assumed	0,408	0,525	3,841	67	0,000	0,98046	0,25525	0,47097	1,48995
Equal variances not assumed			3,994	29,169	0,000	0,98046	0,24549	0,47851	1,48242

Moreover, the statistical *t* value was less than the critical value of 0,05 for all entrepreneurship support mechanisms, except for INDUS_CURRI. Thus it could be concluded that universities which had better results on Hard AEA (first group), promote in a higher level all entrepreneurship support mechanisms except INDUS_CURRI (see Table 94).

Table 94 Means of entrepreneurship support mechanisms in relation to the two clusters of Hard AEA

	Cluster Number of Case	N	Mean	Std. Deviation	Std. Error Mean
POLICIES	1	52	3,7215	,82689	,11467
	2	17	2,6665	,95765	,23226
INDUS_CURRI	1	52	3,0881	,70490	,09775
	2	17	2,7176	,85164	,20655
INTERNATIONALISATION	1	52	3,4788	,72889	,10108
	2	17	2,6894	,88683	,21509
E_FUNDS	1	52	2,6160	,90378	,12533
	2	17	1,8424	,56970	,13817
E_EDUCATION	1	52	3,1737	,84576	,11729
	2	17	2,5294	,94236	,22856
METHODS	1	52	3,2144	,74585	,10343
	2	17	2,4906	,81691	,19813
E_CURRI_ACTIVITIES	1	52	3,6321	,78333	,10863
	2	17	2,4412	,74755	,18131
E_STAFF	1	52	2,6663	,92941	,12889
	2	17	1,6859	,86146	,20893

Soft academic entrepreneurship activities (Soft AEA)

The same process was used in order to analyse Soft AEA. Through the *k*-means cluster analysis, the total amount of universities was divided into two groups due to their Soft AEAs' level. In particular, the fifty-three universities that composed the first group were the ones that obtained better results on Soft AEA and the rest sixteen (the second group) were the ones that obtained worse values (see Table 95).

Table 95 *k*-means cluster based on Soft AEA

	Cluster	
	1 (n=53)	**2 (n=16)**
INFO_DISSEMINATION	3,06	2,27
NETWORKING	3,49	2,48
I_TRAINING	3,34	2,06
IND_MOBILITY	2,65	2,15
CONSULTING	3,38	2,75
PR_RESEARCH	3,17	2,67

The same procedure was following within this analyse, thus first of all the real differences between both groups regarding Entrepreneurial University's results were analysed in order to ratify if the first group only obtain better results in Soft AEA. Therefore a *t*-test was applied (see Table 96 and Table 99). This analysis shows that in addition to Soft AEA, universities from the first group also obtained better results on all Hard AEA.

Table 96 Student's *t*-test for independent samples applied to Entrepreneurial University's results in relation to the two clusters of Soft AEA

	Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
INFO_DISSEMIN.									
Equal variances assumed	2,570	,114	5,253	67	,000	,78824	,15006	,48872	1,08777
Equal variances not assumed			5,887	30,182	,000	,78824	,13389	,51488	1,06161
NETWORKING									
Equal variances assumed	,070	,793	7,782	67	,000	1,00742	,12946	,74902	1,26582
Equal variances not assumed			7,396	23,035	,000	1,00742	,13621	,72567	1,28916
I_TRAINING									
Equal variances assumed	3,609	,062	6,601	67	,000	1,27712	,19348	,89094	1,66331
Equal variances not assumed			7,378	30,019	,000	1,27712	,17311	,92360	1,63064
IND_MOBILITY									
Equal variances assumed	,840	,363	3,001	67	,004	,50526	,16839	,16915	,84137
Equal variances not assumed			2,782	22,296	,011	,50526	,18164	,12884	,88167
CONSULTING									
Equal variances assumed	,065	,800	2,866	67	,006	,62736	,21889	,19045	1,06427
Equal variances not assumed			2,847	24,528	,009	,62736	,22034	,17312	1,08160
PR_RESEARCH									
Equal variances assumed	1,408	,240	2,520	67	,014	,50356	,19980	,10476	,90236
Equal variances not assumed			2,919	32,271	,006	,50356	,17250	,15231	,85481
PATENT_LICENSE									
Equal variances assumed	19,257	,000	3,549	67	,001	,55425	,15617	,24253	,86596
Equal variances not assumed			2,576	17,573	,019	,55425	,21516	,10142	1,00707
ASO									
Equal variances assumed	3,344	,072	3,993	67	,000	,58302	,14601	,29158	,87446
Equal variances not assumed			5,655	52,908	,000	,58302	,10310	,37622	,78982
SSO									
Equal variances assumed	,006	,940	4,589	67	,000	,70401	,15340	,39782	1,01020
Equal variances not assumed			4,852	27,101	,000	,70401	,14511	,40632	1,00170

Table 97 Means of Entrepreneurial University's results in relation to the two clusters of Soft AEA

	Cluster Number of Case	N	Mean	Std. Deviation	Std. Error Mean
INFO_DISSEMINATION	1	53	3,0589	,54770	,07523
	2	16	2,2706	,44301	,11075
NETWORKING	1	53	3,4868	,44374	,06095
	2	16	2,4794	,48724	,12181
I_TRAINING	1	53	3,3396	,70557	,09692
	2	16	2,0625	,57373	,14343
IND_MOBILITY	1	53	2,6515	,57012	,07831
	2	16	2,1463	,65558	,16389
CONSULTING	1	53	3,3774	,76527	,10512
	2	16	2,7500	,77460	,19365
PR_RESEARCH	1	53	3,1698	,73621	,10113
	2	16	2,6663	,55897	,13974
PATENT_LICENSE	1	53	2,6992	,43473	,05971
	2	16	2,1450	,82683	,20671
ASO	1	53	2,6830	,56219	,07722
	2	16	2,1000	,27325	,06831
SSO	1	53	2,8915	,54928	,07545
	2	16	2,1875	,49582	,12395

Once this contrast was done, the next step was to compare the means of both groups using the *t*-test (see Table 98).

Table 98 Student's *t*-test for independent samples applied to entrepreneurship support mechanisms in relation to the two clusters of Soft AEA

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
POLICIES									
Equal variances assumed	0,649	0,423	4,459	67	0,000	1,08996	0,24445	0,60204	1,57789
Equal variances not assumed			4,33	23,728	0,000	1,08996	0,25174	0,57008	1,60985
INDUS_CURRI									
Equal variances assumed	1,922	0,17	4,648	67	0,000	0,87625	0,18853	0,49994	1,25256
Equal variances not assumed			5,625	35,546	0,000	0,87625	0,15577	0,56019	1,19231
INTERNATION.									
Equal variances assumed	0,196	0,66	3,863	67	0,000	0,8405	0,21758	0,40621	1,27479
Equal variances not assumed			3,581	22,299	0,002	0,8405	0,23468	0,35418	1,32681
E_FUNDS									
Equal variances assumed	1,68	0,199	2,803	67	0,007	0,68233	0,24343	0,19644	1,16823
Equal variances not assumed			3,32	33,864	0,002	0,68233	0,20552	0,26461	1,10006
E_EDUCATION									
Equal variances assumed	0,545	0,463	3,335	67	0,001	0,80545	0,24153	0,32336	1,28754
Equal variances not assumed			3,525	27,101	0,002	0,80545	0,22847	0,33674	1,27416
METHODS									
Equal variances assumed	0,365	0,548	2,895	67	0,005	0,64341	0,22225	0,19979	1,08702
Equal variances not assumed			3,325	31,714	0,002	0,64341	0,19349	0,24915	1,03766
E_CURRI_ACTIVITIES									
Equal variances assumed	2,841	0,097	2,621	67	0,011	0,66471	0,25365	0,15842	1,17099
Equal variances not assumed			2,278	20,659	0,034	0,66471	0,29186	0,05715	1,27226
E_STAFF									
Equal variances assumed	10,19	0,002	1,478	67	0,144	0,41876	0,2833	-0,14671	0,98424
Equal variances not assumed			1,153	18,601	0,264	0,41876	0,3632	-0,34252	1,18004

Note that the Levene statistic had an associated p-value greater than the critical significance level of 0,05, thus the assumption of equal variances (the property holds homoscedasticity of variance) was assumed in all cases (except one). Moreover, the statistical *t* value was less than the critical value of 0,05 for all entrepreneurship support mechanisms, except for E_STAFF. Thus it could be concluded that universities which had better results on Soft AEA (first group),

promoted in a higher level all entrepreneurship support mechanisms except E_STAFF (see Table 99).

Table 99 Means of entrepreneurship support mechanisms in relation to the two clusters of Soft AEA

	Cluster Number of Case	N	Mean	Std. Deviation	Std. Error Mean
POLICIES	1	53	3,7143	,84624	,11624
	2	16	2,6244	,89320	,22330
INDUS_CURRI	1	53	3,2000	,70274	,09653
	2	16	2,3238	,48904	,12226
INTERNATIONALISATION	1	53	3,4792	,73669	,10119
	2	16	2,6388	,84697	,21174
E_FUNDS	1	53	2,5836	,90242	,12396
	2	16	1,9012	,65571	,16393
E_EDUCATION	1	53	3,2017	,86484	,11879
	2	16	2,3963	,78065	,19516
METHODS	1	53	3,1853	,81702	,11223
	2	16	2,5419	,63045	,15761
E_CURRI_ACTIVITIES	1	53	3,4928	,82784	,11371
	2	16	2,8281	1,07517	,26879
E_STAFF	1	53	2,5219	,85163	,11698
	2	16	2,1031	1,37536	,34384

5.4.2 The influence of an incubator and a technology park on Entrepreneurial University's results

As it was shown in Chapter 2, the Entrepreneurial University generates technology advances and facilitates the technology diffusion process through intermediaries such as technology transfer offices, incubators and/or technology parks. Increasingly engaging in interactions with industry, the core of the university system expands to include activities outside the ivory tower with the goal of transforming inventions into innovations for the betterment of society and to enhance the university system's cash flow and capital endowments (Rothaermel et al., 2007).

Thereby, it was important to analyse if the possession of an own or affiliated incubator and/or technology park had any influence on both entrepreneurship support mechanisms and Entrepreneurial University's results. In the following lines these hypothesis were tested through a student's *t*-test, which was the most appropriate test when the independent variable divided the sample into two different categories (Pardo and Ruiz, 2002).

Incubator

Then, the influence of possessing an own or affiliated incubator on Entrepreneurial University's results was analysed. As shown in the table below (see Table 100), the Levene statistic had an associated p-value higher than the critical significance level of 0,05 allowing the assumption of equal variances for four cases, IND_MOBILITY, CONSULTING, PATENT_LICENSE, ASO and SSO. So it could be concluded that universities that possessed an own or affiliated incubator obtained better results on IND_MOBILITY, CONSULTING, PATENT_LICENSE, ASO and SSO.

Table 100 Student's *t*-test for independent samples applied to Entrepreneurial University's results in relation to the influence of an incubator

| | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | |
| | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | 95% Confidence Interval of the Difference | |
								Lower	Upper
INFO_DISSEMIN.									
Equal variances assumed	2,094	0,153	1,382	67	0,172	0,21158	0,15312	-0,09405	0,51722
Equal variances not assumed			1,425	58,035	0,159	0,21158	0,14845	-0,08558	0,50874
NETWORKING									
Equal variances assumed	0,659	0,42	0,638	67	0,526	0,09893	0,1551	-0,21065	0,4085
Equal variances not assumed			0,649	55,664	0,519	0,09893	0,15254	-0,20668	0,40454
I_TRAINING									
Equal variances assumed	0,663	0,418	0,609	67	0,545	0,13148	0,21587	-0,2994	0,56237
Equal variances not assumed			0,622	56,334	0,537	0,13148	0,21146	-0,29206	0,55503
IND_MOBILITY									
Equal variances assumed	1,716	0,195	2,605	67	0,011	0,38777	0,14884	0,09069	0,68486
Equal variances not assumed			2,703	58,973	0,009	0,38777	0,14347	0,10069	0,67486
CONSULTING									
Equal variances assumed	5,919	0,018	2,226	67	0,029	0,43381	0,19491	0,04477	0,82285
Equal variances not assumed			2,299	58,285	0,025	0,43381	0,18868	0,05617	0,81145
PR_RESEARCH									
Equal variances assumed	1,307	0,257	0,817	67	0,417	0,14807	0,18117	-0,21355	0,50969
Equal variances not assumed			0,874	63,463	0,385	0,14807	0,16933	-0,19027	0,48641
PATENT_LICENSE									
Equal variances assumed	0,555	0,459	2,531	67	0,014	0,35851	0,14163	0,07582	0,64119
Equal variances not assumed			2,502	50,907	0,016	0,35851	0,14331	0,0708	0,64622
ASO									
Equal variances assumed	2,907	0,093	1,995	67	0,05	0,27424	0,13746	-0,00014	0,54862
Equal variances not assumed			2,239	66,987	0,029	0,27424	0,12251	0,02971	0,51877
SSO									
Equal variances assumed	0,01	0,919	2,852	67	0,006	0,41257	0,14463	0,12388	0,70126
Equal variances not assumed			2,935	57,657	0,005	0,41257	0,14055	0,13119	0,69394

Once the significant Entrepreneurial University's results were identified, it was completely logical that universities which had an own or affiliated incubator obtained better results on all Hard AEA, since the main objective of an incubator is to link talent, technology, capital and know-how in order to accelerate the development of new technology-based firms and speed the commercialisation of technology (Smilor and Gill, 1986).

Furthermore, there were two more Soft AEA which obtained better results in universities with an own or affiliated incubator (see Table 101 and Table 102): IND_MOBILITY and CONSULTING. This fact supported Rothaermel and Thursby (2005) research, which stated that incubators facilitate knowledge flows from the university to the incubator firms using different channels of knowledge flow, such as consulting and personal exchange, among others.

Table 101 Means entrepreneurship support mechanisms in relation to the influence of an incubator

	INCUBATOR	N	Mean	Std. Deviation	Std. Error Mean
INFO_DISSEMINATION	1	43	2,9558	,64337	,09811
	0	26	2,7442	,56809	,11141
NETWORKING	1	43	3,2905	,63939	,09751
	0	26	3,1915	,59814	,11730
I_TRAINING	1	43	3,0930	,89480	,13646
	0	26	2,9615	,82369	,16154
IND_MOBILITY	1	43	2,6805	,63000	,09607
	0	26	2,2927	,54331	,10655

Table 102 Means entrepreneurship support mechanisms in relation to the influence of an incubator (continuation)

	INCUBATOR	*N*	*Mean*	*Std. Deviation*	*Std. Error Mean*
CONSULTING	1	43	3,3953	,82056	,12513
	0	26	2,9615	,72004	,14121
PR_RESEARCH	1	43	3,1088	,79507	,12125
	0	26	2,9608	,60274	,11821
PATENT_LICENSE	1	43	2,7058	,55985	,08538
	0	26	2,3473	,58688	,11510
ASO	1	43	2,6512	,63260	,09647
	0	26	2,3769	,38503	,07551
SSO	1	43	2,8837	,60590	,09240
	0	26	2,4712	,54003	,10591

Technology Park

Using the same statistical procedure, the influence of possessing an affiliated technology park on Entrepreneurial University's results was analysed. As shown in the table below (see Table 103), significant differences were found between the two groups in terms of their likelihood to provide Entrepreneurial University's results, specifically for: PATENT_LICENSE and SSO. Indeed, the Levene statistic had an associated p-value higher than the critical significance level of 0,05 allowing the assumption of equal variances for these two cases, PATENT_LICENSE and SSO.

Table 103 Student's *t*-test for independent samples applied to Entrepreneurial University's results in relation to the influence of a technology park

	Levene's Test for Equality of Variances		*t-test for Equality of Means*						
								95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
INFO_DISSEMIN.									
Equal variances assumed	3,312	0,073	1,516	67	0,134	0,2355	0,15535	-0,07459	0,54559
Equal variances not assumed			1,693	62,493	0,095	0,2355	0,13912	-0,04256	0,51356
NETWORKING									
Equal variances assumed	2,21	0,142	0,447	67	0,656	0,07069	0,15805	-0,24477	0,38616
Equal variances not assumed			0,481	57,441	0,632	0,07069	0,14694	-0,2235	0,36489
I_TRAINING									
Equal variances assumed	0,581	0,449	1,487	67	0,142	0,32222	0,2167	-0,11031	0,75475
Equal variances not assumed			1,618	59,054	0,111	0,32222	0,19919	-0,07636	0,7208
IND_MOBILITY									
Equal variances assumed	3,459	0,067	1,587	67	0,117	0,24753	0,15602	-0,06389	0,55894
Equal variances not assumed			1,727	59,178	0,089	0,24753	0,14329	-0,03918	0,53423
CONSULTING									
Equal variances assumed	4,738	0,033	1,119	67	0,267	0,22778	0,20361	-0,17864	0,63419
Equal variances not assumed			1,221	59,504	0,227	0,22778	0,18656	-0,14547	0,60103
PR_RESEARCH									
Equal variances assumed	0,404	0,527	1,564	67	0,123	0,2845	0,18196	-0,07869	0,64769
Equal variances not assumed			1,654	55,06	0,104	0,2845	0,17197	-0,06012	0,62912
PATENT_LICENSE									
Equal variances assumed	0,16	0,69	1,89	67	0,063	0,27775	0,14696	-0,01559	0,57109
Equal variances not assumed			1,944	50,98	0,057	0,27775	0,14287	-0,00907	0,56457
ASO									
Equal variances assumed	0,181	0,672	1,325	67	0,19	0,18833	0,1421	-0,09531	0,47197
Equal variances not assumed			1,371	51,742	0,176	0,18833	0,13741	-0,08743	0,4641
SSO									
Equal variances assumed	0,384	0,538	1,995	67	0,05	0,30208	0,1514	-0,00012	0,60428
Equal variances not assumed			1,939	43,423	0,059	0,30208	0,15581	-0,01205	0,61622

According to Siegel and Phan (2005), the existence of a formal relationship with a technology park enables a university to generate more scholarly publications and patents and also allows them to more easily place Ph.D. students and hire preeminent scholars. Moreover, the science park provided both an ideal ground for UBC and an arena for entrepreneurship (Zhou, 2008). Following in this vein, the present research showed that universities possessing an affiliated technology park obtained better results on PATENT_LICENSE and SSO (see Table 104).

Table 104 Means Entrepreneurial University's results in relation to the influence of a technology park

	TECH_PARK	N	Mean	Std. Deviation	Std. Error Mean
INFO_DISSEMINATION	1	45	2,9580	,67891	,10121
	0	24	2,7225	,46764	,09546
NETWORKING	1	45	3,2778	,67074	,09999
	0	24	3,2071	,52750	,10768
I_TRAINING	1	45	3,1556	,92823	,13837
	0	24	2,8333	,70196	,14329
IND_MOBILITY	1	45	2,6204	,66878	,09970
	0	24	2,3729	,50420	,10292
CONSULTING	1	45	3,3111	,87444	,13035
	0	24	3,0833	,65386	,13347
PR_RESEARCH	1	45	3,1520	,76139	,11350
	0	24	2,8675	,63291	,12919
PATENT_LICENSE	1	45	2,6673	,59893	,08928
	0	24	2,3896	,54639	,11153
ASO	1	45	2,6133	,58216	,08678
	0	24	2,4250	,52191	,10653
SSO	1	45	2,8333	,57899	,08631
	0	24	2,5313	,63551	,12972

5.4.3   A predictive model for Entrepreneurial University's results

This section seeks to estimate a predictive model and identify the most critical factors (based on the entrepreneurship support mechanisms) which must be influenced in order to evolve a university within the Entrepreneurial University path; increasing it Entrepreneurial University's results (both Hard AEA and Soft AEA). Furthermore, to achieve this objective two different methods were followed, since both undertook the same task by predicting an outcome: the discriminant function analysis and the multiple linear regression.

In fact, the multiple regression was presented as a flexible technique for analysing the relationships between multiple independent variables and a single dependent variable (Spicer, 2005); however, this flexibility stops short of allowing a dependent variable consisting of categories. On the contrary, the discriminant analysis discriminates a single classification variable using multiple attributes (Fernandez, 2002); which results in a predictive model. Due to these differences, it was interesting to conduct both analyses and contrast the differences between them.

Finally, it is worth mentioning that both statistical techniques were applied twice; the firstly for analysing Hard AEA and then for analysing Soft AEA.

5.4.3.1 Using the Discriminant Function Analysis method

Discriminant function analysis was used to determine which variables discriminate between two or more naturally occurring groups. Thus, through the present section, the variables which discriminate between the universities which obtain low, medium or high values on Soft AEA and Hard AEA were identified. This statistical approach was used by various scholars in the entrepreneurship research stream, such as Brazeal (1996), Ibeh (2003) and Moreno and Casillas (2007), among others; and specifically in research on Entrepreneurial Universities, such as Harman (2003), Serbanica (2012), Berbegal-Mirabent et al. (2013) and Ambali et al. (2014).

To perform this procedure, a grouping variable had to be established, which defined the different membership groups or categories. In order to do this classification, a cluster analysis was carried out. This combined procedure (Galbraith and Lu, 1999), the cluster analysis and discriminant analysis as a package, enables the organisation of the universities into groups with similar Soft AEA and Hard AEA level and the subsequent analysis to find the discriminant function(s) which can differentiate the groups. Thereby, through the next two sections a discriminant analysis was performed twice; first using the Hard AEA as dependent variables and then using the Soft AEA.

Hard academic entrepreneurship activities (Hard AEA)

A *k*-means cluster analysis was developed in order to classify the universities regarding their level of Hard AEA, into three different groups: Cluster 1 composed by seven universities (high values in Hard AEA), Cluster 2 composed by sixteen universities (low values in all Hard AEA) and Cluster 3 composed by forty-six universities (mean values on Hard AEA) (see Graph 17).
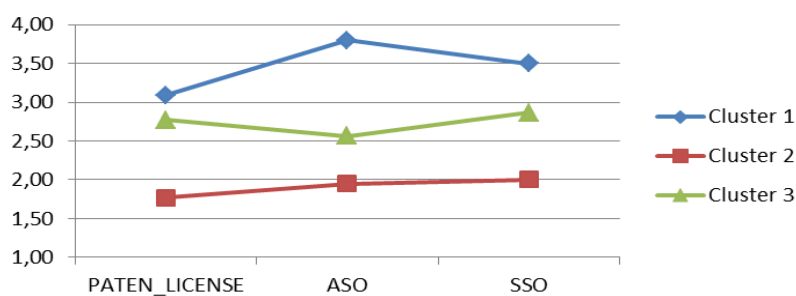
Graph 17 Hard AEA of the three clusters

Based on these three clusters it was interesting to analyse their differences regarding the entrepreneurship support mechanisms. To achieve this objective, an ANOVA was performed in order to analyse the differences between groups (see Table 105); which showed all p-values under the threshold 0,005, falling to reject the null hypothesis.

Table 105 ANOVA analysis of entrepreneurship support mechanisms for the three clusters based on Hard AEA

		ANOVA				
		Sum of Squares	df	Mean Square	F	Sig.
POLICIES	Between Groups	15,528	2	7,764	10,614	,000
	Within Groups	48,278	66	,731		
	Total	63,806	68			
INDUS_CURRI	Between Groups	4,236	2	2,118	4,056	,022
	Within Groups	34,468	66	,522		
	Total	38,704	68			
INTERNATION.	Between Groups	12,146	2	6,073	11,285	,000
	Within Groups	35,517	66	,538		
	Total	47,663	68			
E_FUNDS	Between Groups	10,771	2	5,386	8,125	,001
	Within Groups	43,747	66	,663		
	Total	54,518	68			
E_EDUCATION	Between Groups	5,676	2	2,838	3,722	,029
	Within Groups	50,331	66	,763		
	Total	56,007	68			
METHODS	Between Groups	8,174	2	4,087	7,177	,002
	Within Groups	37,587	66	,569		
	Total	45,761	68			
E_CURRI_ACTIV.	Between Groups	20,023	2	10,012	17,215	,000
	Within Groups	38,383	66	,582		
	Total	58,407	68			
E_STAFF	Between Groups	14,923	2	7,462	9,236	,000
	Within Groups	53,320	66	,808		
	Total	68,243	68			

Once the differences between groups' means were demonstrated, it was continued with the discriminant analysis. In order to develop this analysis, and according to Poulsen and French (2004) and Errasti (2009) four different assumptions have to be taken into account. In the following lines the results of these assumptions are shown.

i. The predictor variables (the independent variables in this case) were not highly correlated (see Table 106).

Table 106 Correlations between entrepreneurship support mechanisms

		Correlations[c]							
		1	2	3	4	5	6	7	8
1	Pearson Correlation	1	,432**	,521**	,561**	,396**	,476**	,708**	,470**
	Sig. (2-tailed)		,000	,000	,000	,001	,000	,000	,000
2	Pearson Correlation	,432**	1	,639**	,558**	,497**	,521**	,314**	,272*
	Sig. (2-tailed)	,000		,000	,000	,000	,000	,009	,024
3	Pearson Correlation	,521**	,639**	1	,533**	,484**	,493**	,428**	,442**
	Sig. (2-tailed)	,000	,000		,000	,000	,000	,000	,000
4	Pearson Correlation	,561**	,558**	,533**	1	,545**	,555**	,661**	,543**
	Sig. (2-tailed)	,000	,000	,000		,000	,000	,000	,000
5	Pearson Correlation	,396**	,497**	,484**	,545**	1	,651**	,495**	,484**
	Sig. (2-tailed)	,001	,000	,000	,000		,000	,000	,000
6	Pearson Correlation	,476**	,521**	,493**	,555**	,651**	1	,479**	,399**
	Sig. (2-tailed)	,000	,000	,000	,000	,000		,000	,001
7	Pearson Correlation	,708**	,314**	,428**	,661**	,495**	,479**	1	,672**
	Sig. (2-tailed)	,000	,009	,000	,000	,000	,000		,000
8	Pearson Correlation	,470**	,272*	,442**	,543**	,484**	,399**	,672**	1
	Sig. (2-tailed)	,000	,024	,000	,000	,000	,001	,000	

1.POLICIES; 2.INDUS_CURRI; 3.INTERNATION.; 4.E_FUNDS; 5.E_EDUCATION; 6.METHODS; 7.E_CURRI_ACTIV.; 8.E_STAFF
**. Correlation is significant at the 0,01 level (2-tailed).
*. Correlation is significant at the 0,05 level (2-tailed).
c. Listwise N=69

ii. The homogeneity of variances and covariances (i.e. equality of the variance-covariance matrices for each group) was an important assumption; this was the multivariate extension of univariate homogeneity of within group variances. Box's M tests the null hypothesis of equal variance-covariance matrices. In this case the null hypothesis was accepted (accepted significance level < 0,05), so that groups did not have the same variability (see Table 107).

Table 107 Box's M for testing equality of covariance matrices

Test Results^a		
Box's M		111,484
F	Approx.	2,432
	df1	36
	df2	2796,850
	Sig.	,000
Tests null hypothesis of equal population covariance matrices.		

iii. The correlation between two predictor variables held constant at the different categories of the grouping variable.

This assumption was contrasted through a univariate F contrast of equal means between the three groups for each of the eight entrepreneurship support mechanisms. High values of F, for a specific variable associated with low levels of significance, implied a rejection of the equality of means between groups hypothesis. Thus, the tests of equality of the group means (see Table 108) showed significant differences for all the variables (sig < 0,05).

Table 108 Univariate Tests of means equality between groups

Tests of Equality of Group Means					
	Wilks' Lambda	F	df1	df2	Sig.
POLICIES	,757	10,614	2	66	,000
INDUS_CURRI	,891	4,056	2	66	,022
INTERNATIONALISATION	,745	11,285	2	66	,000
E_FUNDS	,802	8,125	2	66	,001
E_EDUCATION	,899	3,722	2	66	,029
METHODS	,821	7,177	2	66	,002
E_CURRI_ACTIVITIES	,657	17,215	2	66	,000
E_STAFF	,781	9,236	2	66	,000

iv. All the predictor or independent variables were normally distributed; this fact was confirmed in Section 5.1.1.

Once the sustainability of the variables was analysed, the discriminant analysis was developed. From the application of this analysis two discriminant functions representing the analysed cases were estimated. In Table 109 the coefficients corresponding to the discriminant functions were set, and afterwards the functions.

Table 109 Coefficients of canonical discriminant functions

Canonical Discriminant Function Coefficients		
	Function	
	1	2
POLICIES	,045	-,180
INDUS_CURRI	-,289	1,104
INTERNATIONALISATION	,875	-,595
E_FUNDS	-,224	,977
E_EDUCATION	-,323	-,137
METHODS	,454	-,065
E_CURRI_ACTIVITIES	,958	-,523
E_STAFF	,138	,226
(Constant)	-5,562	-1,294
Unstandardized coefficients		

$$F1 = -5,5632 + 0,045 \text{ POLICIES} - 0,289 \text{ INDUS\_CURRI} \ldots + 0,138 \text{ E\_STAFF}$$

$$F2 = -1,294 - 0,180 \text{ POLICIES} + 1,104 \text{ INDUS\_CURRI} \ldots - 1,294 \text{ E\_STAFF}$$

These two functions were obtained sequentially and the first one had the higher discriminant ability; since as it was shown in Table 110, this first function had a discriminating capacity of 91,1%, while the percentage of the variance accounted for the second function is 8,9%. Canonical correlation coefficients corroborated this fact, providing a value of 0,674 for the first function and 0,274 for the second.

Table 110 % of explained variance by each discriminate function and canonical correlation coefficients

Eigenvalues				
Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	,831[a]	91,1	91,1	,674
2	,081[a]	8,9	100,0	,274
a. First 2 canonical discriminant functions were used in the analysis.				

These values were also used to analyse the proportion of the explained variance by each function. Thus, the first function explained the 45,42% of the variance ($0,674^2$ x 100) between two groups, while the latter counted for the 7,50% ($0,274^2$ x 100) of the remaining variance (the variance that the first function did not explain); that is 4,09% (((100% - 45,42) x 7,5)/100). Thereby, adding both variances a total variance of 49,51% (45,42% + 4,09%) was explained.

Table 111 shows the values for the Wilks Lambda statistic test which measured the significance of each discriminant function. In this case, it was observed that the first function was statistically significant at the 0,05 level and the second one no. However, it was chosen to keep on using the second function.

Table 111 Statistic Wilks Lambda

Wilks' Lambda				
Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1 through 2	,505	42,659	16	,000
2	,925	4,861	7	,677

The standardised canonical discriminant function coefficients, which showed the absolute contribution of a variable to determine the discriminant score, were shown in Table 112. In this case, with respect to the first function, the variable that helped to differentiate the three groups is E_CURRI_ACTIVITIES, followed by

INTERNATIONALISATION. Regarding the second function, the variable that contributed to the differentiation between the three groups were INDUS_CURRI and E_FUNDS.

Table 112 Standardised coefficients of canonical discriminant functions

Standardised Canonical Discriminant Function Coefficients		
	Function	
	1	2
POLICIES	,038	-,154
INDUS_CURRI	-,209	,798
INTERNATIONALISATION	,642	-,436
E_FUNDS	-,182	,795
E_EDUCATION	-,282	-,120
METHODS	,343	-,049
E_CURRI_ACTIVITIES	,731	-,398
E_STAFF	,124	,203

The next step was to analyse if the discriminant variables were correlated with the estimated functions and how. In order to achieve this, the structure matrix (see Table 113) was calculated which showed, in descending order, the variables that were correlated with each function. In this case, all variables except INDUS_CURRI and E_FUNDS were correlated with the first function and only INDUS_CURRI and E_FUNDS with the second.

Table 113 Structure Matrix

Structure Matrix		
	Function	
	1	2
E_CURRI_ACTIVITIES	,792*	,097
INTERNATIONALISATION	,637*	,234
POLICIES	,621*	,114
E_STAFF	,576*	,233
METHODS	,501*	,326
E_EDUCATION	,357*	,288
INDUS_CURRI	,307	,744*
E_FUNDS	,497	,715*

Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions
Variables ordered by absolute size of correlation within function.
*. Largest absolute correlation between each variable and any discriminant function

Finally, as a conclusion of the estimation model, Table 114 showed the corresponding centroids of each cluster. At a glance, the numbers showed that function 1 had more discriminating power, since the distances between the centroids were greater than the distances calculated in the second function. This fact was proven on several occasions throughout the analysis.

Table 114 Functions at group centroids

Functions at Group Centroids		
Cluster Number of Case	Function	
	1	2
1	1,182	,741
2	-1,561	,138
3	,363	-,161

Unstandardised canonical discriminant functions evaluated at group means

Furthermore, these centroids and the natural boundaries of each group were shown in the territorial map below (see Figure 19).

```
                                 Territorial Map
Canonical Discriminant
Function 2
      -8,0      -6,0      -4,0      -2,0       ,0       2,0       4,0       6,0       8,0
       +--------+---------+---------+---------+---------+---------+---------+---------+
   8,0 +                              21                                              +
       I                              21                                              I
       I                              21                                              I
       I                             21                                               I
       I                             21                                               I
       I                             21                                               I
   6,0 +         +         +         + 21      +         +         +         +         +
       I                             21                                               I
       I                             21                                               I
       I                            21                                                I
       I                            21                                                I
       I                            21                                                I
   4,0 +         +         +         + 21      +         +         +         +         +
       I                             21                                               I
       I                              21                                              I
       I                              21                                              I
       I                              21                                              I
       I                               21                                             I
   2,0 +         +         +         +  21 +       +         +         +         +     +
       I                                21                                            I
       I                                21                                            I
       I                              2311                                            I
       I                             233311  *                                        I
       I                              23    3311                                      I
    ,0 +         +         +         + *    23 + * 331   +         +         +         +
       I                                23        311                                 I
       I                                23        3311                                I
       I                               23          3311                               I
       I                               23           3311                              I
       I                               23             3311                            I
  -2,0 +         +         +         +  23    +       + 331  +         +         +     +
       I                              23              311                             I
       I                              23               3311                           I
       I                              23                3311                          I
       I                              23                 3311                         I
       I                             23                   3311                        I
  -4,0 +         +         +         + 23      +         +       331 +         +       +
       I                             23                           311                 I
       I                             23                           3311                I
       I                             23                             3311     I
       I                             23                              3311    I
       I                             23                               3311 I
  -6,0 +         +         +         + 23      +         +         +         331 +
       I                             23                                        31I
       I                             23                                         3I
       I                             23                                          I
       I                            23                                           I
       I                            23                                           I
  -8,0 +                            23                                           +
       +--------+---------+---------+---------+---------+---------+---------+---------+
      -8,0      -6,0      -4,0      -2,0       ,0       2,0       4,0       6,0       8,0
                             Canonical Discriminant Function 1
```

```
Symbols used in territorial map

Symbol  Group  Label
------  -----  --------------------


   1        1
   2        2
   3        3
   *               Indicates a group centroid
```

Figure 19 Territorial Map

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In the following figures (see Figure 20) each cluster was represented with respect to the two estimated discriminant canonical functions; showing their arrangement in the space and their centroids.
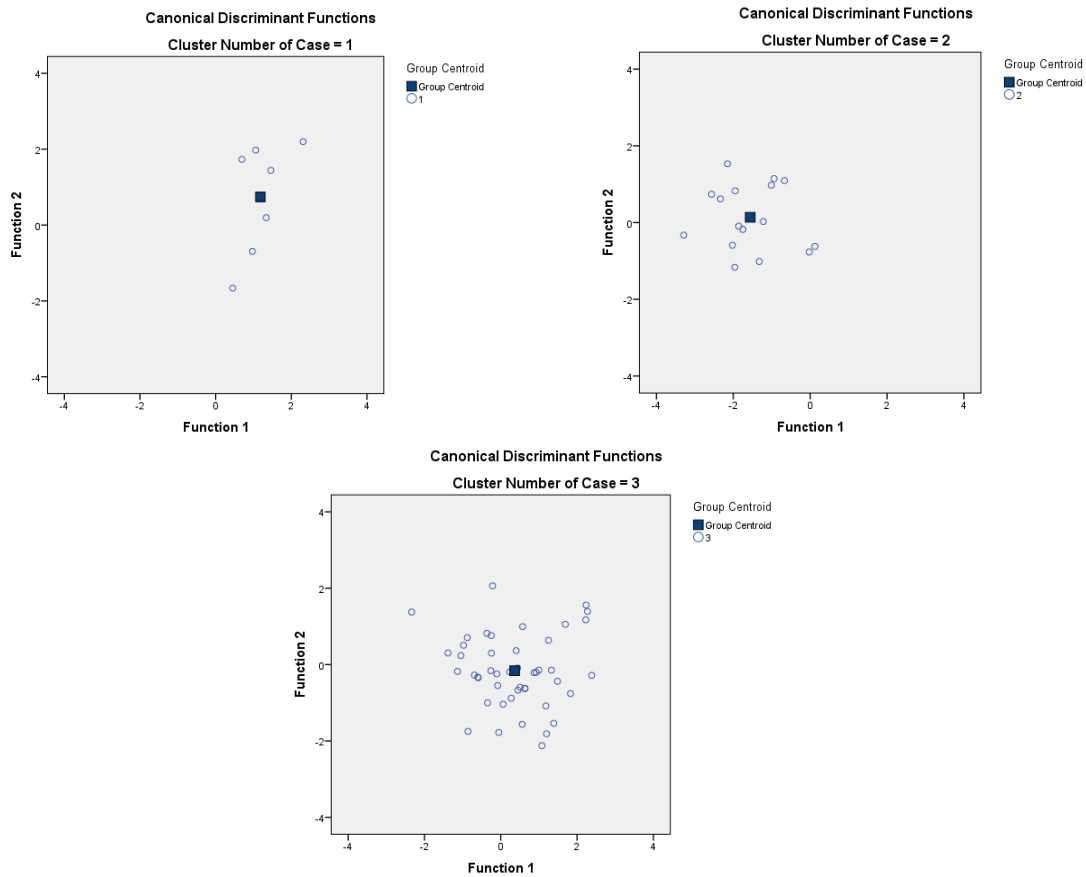

Figure 20 Distribution of cases corresponding to each category of Hard AEA

Finally, in Figure 21, the sixty-nine cases were shown in a point cloud; differentiating each cluster with different patterns. As it can be seen, although the boundaries between groups were quite clear, and in fact, the centroids were located at a considerable distance from one to another; cases of overlap between the groups were given.
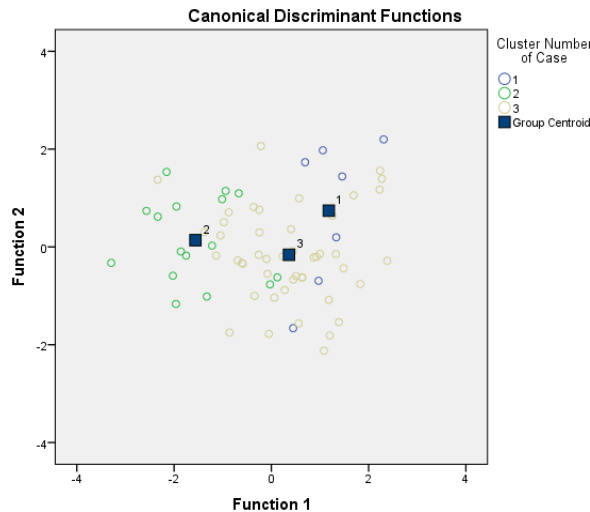
Figure 21 Representation of the distribution of all analysed cases of Hard AEA

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Once the clusters have been graphed, the next step was to assess the predictive ability of the model. First, the evaluation was done under the premise that the three classification groups had the same size; and then, the effect of correspondence to predict either group depending on the size of allocations to either initial group was assessed. For this the confusion matrix was used.

Assuming that the three groups had the same size, the confusion matrix (Table 115) results in a 71,0% of probability that a case was classified correctly (forty-nine of the sixty-nine analysed cases were correctly classified). Specifically, there was a confidence level of 71,4% for Cluster 1, 87,5% for Cluster 2 and 65,2% for Cluster 3. Furthermore, since the model estimation was made based on known cases, the probability of classifying a new case was estimated optimistically, so in order to avoid this criticism, a cross-validation was done. Thus, the probability of classifying correctly a case fell to 52,2%.

Table 115 Confusion matrix (Assumption 2: proportional to group sizes probabilities)

		Cluster Number of Case	Predicted Group Membership 1	2	3	Total
Original	Count	1	5	0	2	7
		2	0	14	2	16
		3	9	7	30	46
	%	1	71,4	,0	28,6	100,0
		2	,0	87,5	12,5	100,0
		3	19,6	15,2	65,2	100,0
Cross-validated[b]	Count	1	3	0	4	7
		2	0	11	5	16
		3	13	11	22	46
	%	1	42,9	,0	57,1	100,0
		2	,0	68,8	31,3	100,0
		3	28,3	23,9	47,8	100,0

a. 71,0% of original grouped cases correctly classified.
b. Cross validation is done only for those cases in the analysis. In cross validation, each case is classified by the functions derived from all cases other than that case.
c. 52,2% of cross-validated grouped cases correctly classified.

Soft academic entrepreneurship activities (Soft AEA)

The same procedure was followed for Soft AEA. A *k*-means cluster analysis was developed in order to classify the universities regarding their level of Soft AEA, into three different groups: Cluster 1 composed by thirteen universities (high values in Soft AEA), Cluster 2 composed by forty-seven universities (mean values in all Soft AEA) and Cluster 3 composed by nine universities (low values on Soft AEA) (see Graph 18).
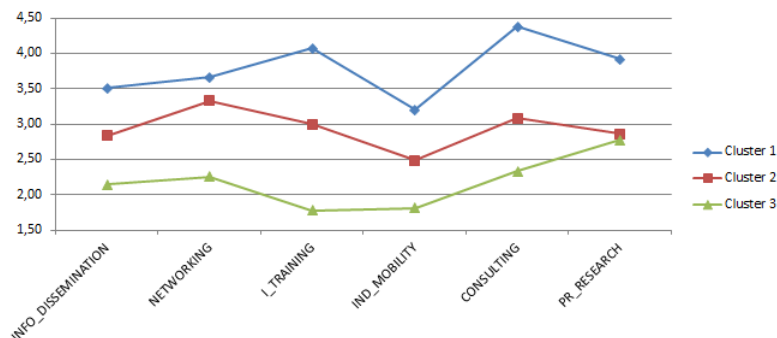
Graph 18 Soft AEA of the three clusters

Based on these three clusters, their differences regarding the entrepreneurship support mechanisms were analysed. To achieve this objective, an analysis of variance (ANOVA) was performed (see Table 116); which shown all p-values under the threshold 0,005, falling to reject the null hypothesis.

Table 116 ANOVA analysis of entrepreneurship support mechanisms for the three clusters based on Soft AEA

		Sum of Squares	df	Mean Square	F	Sig.
		ANOVA				
POLICIES	Between Groups	18,091	2	9,046	13,059	,000
	Within Groups	45,715	66	,693		
	Total	63,806	68			
INDUS_CURRI	Between Groups	11,021	2	5,511	13,138	,000
	Within Groups	27,683	66	,419		
	Total	38,704	68			
INTERNATION.	Between Groups	12,134	2	6,067	11,270	,000
	Within Groups	35,529	66	,538		
	Total	47,663	68			
E_FUNDS	Between Groups	5,896	2	2,948	4,002	,023
	Within Groups	48,622	66	,737		
	Total	54,518	68			
E_EDUCATION	Between Groups	5,533	2	2,767	3,618	,032
	Within Groups	50,474	66	,765		
	Total	56,007	68			
METHODS	Between Groups	5,862	2	2,931	4,849	,011
	Within Groups	39,899	66	,605		
	Total	45,761	68			
E_CURRI_ACTIV.	Between Groups	11,941	2	5,970	8,480	,001
	Within Groups	46,466	66	,704		
	Total	58,407	68			
E_STAFF	Between Groups	14,464	2	7,232	8,875	,000
	Within Groups	53,780	66	,815		
	Total	68,243	68			

Once the differences between groups' means were demonstrated, it was continued with the discriminant analysis. In order to develop this analysis, the four different assumptions were taken into account again:

i. The predictor variables (the independent variables in this case) were not highly correlated (see Table 117).

Table 117 Correlations between entrepreneurship support mechanisms

		1	2	3	4	5	6	7	8
1	Pearson Correlation	1	,432**	,521**	,561**	,396**	,476**	,708**	,470**
	Sig. (2-tailed)		,000	,000	,000	,001	,000	,000	,000
2	Pearson Correlation	,432**	1	,639**	,558**	,497**	,521**	,314**	,272*
	Sig. (2-tailed)	,000		,000	,000	,000	,000	,009	,024
3	Pearson Correlation	,521**	,639**	1	,533**	,484**	,493**	,428**	,442**
	Sig. (2-tailed)	,000	,000		,000	,000	,000	,000	,000
4	Pearson Correlation	,561**	,558**	,533**	1	,545**	,555**	,661**	,543**
	Sig. (2-tailed)	,000	,000	,000		,000	,000	,000	,000
5	Pearson Correlation	,396**	,497**	,484**	,545**	1	,651**	,495**	,484**
	Sig. (2-tailed)	,001	,000	,000	,000		,000	,000	,000
6	Pearson Correlation	,476**	,521**	,493**	,555**	,651**	1	,479**	,399**
	Sig. (2-tailed)	,000	,000	,000	,000	,000		,000	,001
7	Pearson Correlation	,708**	,314**	,428**	,661**	,495**	,479**	1	,672**
	Sig. (2-tailed)	,000	,009	,000	,000	,000	,000		,000
8	Pearson Correlation	,470**	,272*	,442**	,543**	,484**	,399**	,672**	1
	Sig. (2-tailed)	,000	,024	,000	,000	,000	,001	,000	

1.POLICIES; 2.INDUS_CURRI; 3.INTERNATION.; 4.E_FUNDS; 5.E_EDUCATION; 6.METHODS; 7.E_CURRI_ACTIV.; 8.E_STAFF.
**. Correlation is significant at the 0,01 level (2-tailed).
*. Correlation is significant at the 0,05 level (2-tailed).
c. Listwise N=69

ii. The homogeneity of variances and covariances (i.e. equality of the variance-covariance matrices for each group) was an important assumption; this was the multivariate extension of univariate homogeneity of within group variances. Box's M tests the null hypothesis of equal variance-covariance matrices. In this case the null hypothesis was accepted (accepted significance level < 0,05), so that groups did not have the same variability (see Table 118).

Table 118 Box's M for testing equality of covariance matrices

Test Results		
Box's M		146,176
F	Approx.	1,336
	df1	72
	df2	1729,874
	Sig.	,034
Tests null hypothesis of equal population covariance matrices.		

iii. The correlation between two predictor variables held constant at the different categories of the grouping variable.

This assumption was contrasted through a univariate F contrast of equal means between the three groups for each of the eight entrepreneurship support mechanisms. High values of F, for a specific variable associated with low levels of significance, implied a rejection of the equality of means between groups hypothesis. Thus, the tests of equality of the group means (see Table 119) showed significant group mean differences for all the variables (sig < 0,05).

Table 119 Univariate Tests of means equality between groups

Tests of Equality of Group Means					
	Wilks' Lambda	*F*	*df1*	*df2*	*Sig.*
POLICIES	,716	13,059	2	66	,000
INDUS_CURRI	,715	13,138	2	66	,000
INTERNATIONALISATION	,745	11,270	2	66	,000
E_FUNDS	,892	4,002	2	66	,023
E_EDUCATION	,901	3,618	2	66	,032
METHODS	,872	4,849	2	66	,011
E_CURRI_ACTIVITIES	,796	8,480	2	66	,001
E_STAFF	,788	8,875	2	66	,000

iv. All the predictor or independent variables were normally distributed; this fact has already been confirmed in Section 4.2.1.

Once the sustainability of the variables were analysed, the discriminant analysis was developed. From the application of this analysis two discriminant functions representing the analysed cases were estimated. In Table 120 the coefficients corresponding to the discriminant functions were set, which certainly could be defined as follow:

F1 = -6,108 + 0,668 POLICIES + 0,934 INDUS_ CURRI ... - 0,014 E_STAFF

F2 = -0,680 - 0,286 POLICIES - 0,671 INDUS_ CURRI ... + 1,012 E_STAFF

Table 120 Coefficients of canonical discriminant functions

Canonical Discriminant Function Coefficients		
	Function	
	1	2
POLICIES	,668	-,286
INDUS_CURRI	,934	-,671
INTERNATIONALISATION	,442	,170
E_FUNDS	-,481	-,498
E_EDUCATION	-,062	-,206
METHODS	,002	,306
E_CURRI_ACTIVITIES	,278	,470
E_STAFF	-,014	1,012
(Constant)	-6,108	-,680
Unstandardized coefficients		

These two functions were obtained sequentially and the first one had the higher discriminant ability; since as it was shown in Table 121, this first function had a discriminating capacity of 71,3%, while the percentage of the variance accounted for the second function is 28,7%. Canonical correlation coefficients corroborated this fact, providing a value of 0,644 for the first function and 0,471 for the second.

Table 121 % of explained variance by each discriminate function and canonical correlation coefficients

Eigenvalues				
Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	,707a	71,3	71,3	,644
2	,285a	28,7	100,0	,471
a. First 2 canonical discriminant functions were used in the analysis.				

These values were also used to analyse the proportion of the explained variance by each function. Thus, the first function explained the 41,47% of the variance (0,644² x 100) between two groups difference, while the latter counts for the 22,18% (0,471² x 100) of the remaining variance (the variance that the first function did not explain); that was 19,75% (((100% - 41,47) x 33,75)/100). Thereby, adding both variances a total variance of 61,22% (41,47% + 19,75%) was explained.

Table 122 shows the values for the Wilks Lambda statistic test which measures the significance of each discriminant function. In this case, it was observed that both functions were statistically significant at the 0,05 level.

Table 122 Statistic Wilks Lambda

Wilks' Lambda				
Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1 through 2	,456	49,080	16	,000
2	,778	15,665	7	,028

The standardised canonical discriminant function coefficients, which show the absolute contribution of a variable to determine the discriminant score, were shown in Table 123. In this case, with respect to the first function, the variable that helped to differentiate the three groups was INDUS_CURRI, followed by POLICIES and E_FUNDS. Regarding the second function, the variable that contributed to the differentiation between the three groups was E_STAFF, followed by INDUS_CURRI and E_FUNDS.

Table 123 Standardised coefficients of canonical discriminant functions

Standardised Canonical Discriminant Function Coefficients		
	Function	
	1	2
POLICIES	,556	-,238
INDUS_CURRI	,605	-,434
INTERNATIONALISATION	,325	,124
E_FUNDS	-,413	-,428
E_EDUCATION	-,054	-,180
METHODS	,001	,238
E_CURRI_ACTIVITIES	,233	,395
E_STAFF	-,013	,914

The next step was to analyse if the discriminant variables were correlated with the estimated functions and how. For this, the structure matrix (see Table 124) was calculated which showed, in descending order, the variables that were correlated with each function. In this case, all variables except E_STAFF were correlated with the first function and only E_STAFF with the second.

Table 124 Structure matrix

Structure Matrix		
	Function	
	1	2
POLICIES	,742*	,148
INDUS_CURRI	,724*	-,311
INTERNATIONALISATION	,692*	,095
E_CURRI_ACTIVITIES	,516*	,492
METHODS	,447*	,143
E_FUNDS	,413*	,056
E_EDUCATION	,386*	,123
E_STAFF	,373	,773*

Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions
Variables ordered by absolute size of correlation within function.
*. Largest absolute correlation between each variable and any discriminant function

Finally, as a conclusion of the estimation model, Table 125 showed the corresponding centroids of each cluster. At a glance, the numbers showed that function 1 had more discriminating power, since the distances between the centroids were greater than the distances calculated in the second function. This fact was proven on several occasions throughout the analysis.

Table 125 Functions at group centroids

Functions at Group Centroids		
Cluster Number of Case	Function	
	1	2
1	,928	-,909
2	,120	,349
3	-1,966	-,509

Unstandardised canonical discriminant functions evaluated at group means

Furthermore, these centroids and the natural boundaries of each group were shown in the territorial map below (see Figure 22).

```
                              Territorial Map
Canonical Discriminant
Function 2
        -8,0       -6,0       -4,0       -2,0        ,0        2,0        4,0        6,0        8,0
         +---------+---------+---------+---------+---------+---------+---------+---------+
     8,0 +                 32                                                              +
       I                   32                                                             I
       I                   32                                                             I
       I                   32                                                             I
       I                    32                                                            I
       I                     32                                                           I
     6,0 +         +         +  32     +         +         +         +         +           +
       I                     32                                                           I
       I                      32                                                          I
       I                       32                                                         I
       I                       32                                                         I
       I                        32                                                    222I
     4,0 +         +         +   32 +        +         +         +         +    22111+
       I                        32                                        22211   I
       I                        32                                      222111    I
       I                         32                                   22111       I
       I                         32                                 22211         I
       I                          32                              22111           I
     2,0 +         +         +     +32      +         +       22211     +           +
       I                          32                      222111                   I
       I                           32                   22111                      I
       I                            32                 22211                       I
       I                             32               22111                        I
       I                              32       *     22211                         I
      ,0 +         +         +        +  32    +    22111+        +         +        +
       I                              32    22211                                  I
       I                        *     32 222111                                    I
       I                                32111    *                                 I
       I                                31                                         I
       I                                31                                         I
    -2,0 +         +         +        +  31 +        +         +         +         + +
       I                                31                                         I
       I                                31                                         I
       I                                31                                         I
       I                                31                                         I
       I                               31                                          I
    -4,0 +         +         +        +  31 +        +         +         +         + +
       I                                31                                         I
       I                                31                                         I
       I                                31                                         I
       I                               31                                          I
       I                               31                                          I
    -6,0 +         +         +        +  31 +        +         +         +         + +
       I                                31                                         I
       I                              31                                           I
       I                              31                                           I
       I                              31                                           I
       I                              31                                           I
    -8,0 +                           31                                             +
         +---------+---------+---------+---------+---------+---------+---------+---------+
        -8,0       -6,0       -4,0       -2,0        ,0        2,0        4,0        6,0        8,0
                         Canonical Discriminant Function 1
```

```
Symbols used in territorial map

Symbol  Group  Label
------  -----  --------------------

   1       1
   2       2
   3       3
   *           Indicates a group centroid
```

Figure 22 Territorial map

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And in the following figures (Figure 23) each cluster was represented with respect to the two estimated discriminant canonical functions; showing their arrangement in the space and their centroids.
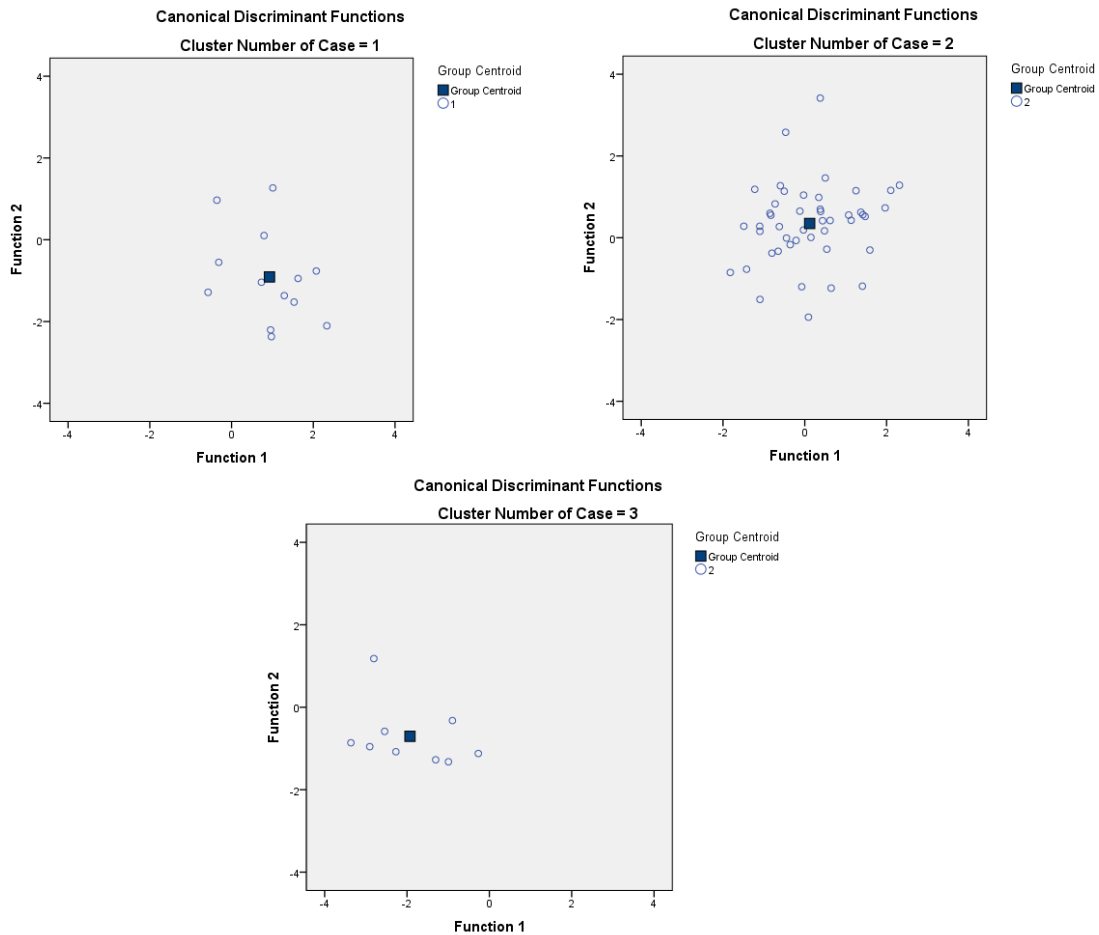
Figure 23 Distribution of cases corresponding to each category of Soft AEA

Finally, in Figure 24, the sixty-nine cases were shown in a point cloud; differentiating each cluster with different patterns. As it can be seen, although the boundaries between groups were quite clear, and in fact, the centroids were located at a considerable distance from one to another; cases of overlap between the groups were always given.
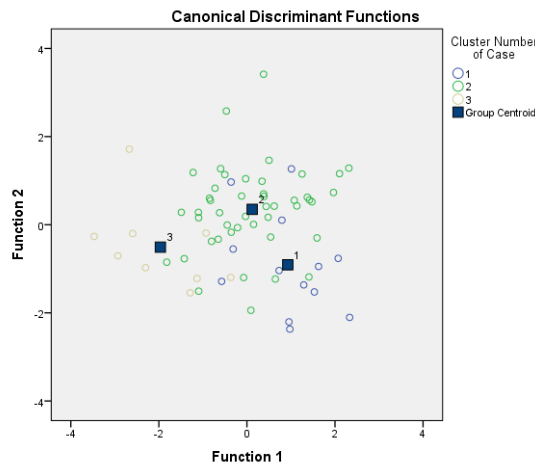
Figure 24 Representation of the distribution of all analysed cases of Soft AEA

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Once the clusters were graphed, the next step was to assess the predictive ability of the model. First, the evaluation was done under the premise that the three classification groups had the same size; and then, the effect of correspondence to predict either group depending on the size of allocations to either initial group was assessed. For this the confusion matrix was used.

Assuming that the three groups had the same size, the confusion matrix (Table 126) resulted in a 73,9% of probability that a case was classified correctly (51 of the sixty-nine analysed cases was correctly classified). Specifically, a confidence level of 69,2% was achieved for Cluster 1, 72,3% for Cluster 2 and 88,9% for Cluster 3. Furthermore, since the model estimation was made based on known cases, the probability of classifying a new case was estimated optimistically, so in order to avoid this criticism, a cross-validation was done. Thus, the probability of classifying correctly a case falls to 60,9%.

Table 126 Confusion matrix (Assumption 2: proportional to group sizes probabilities)

			Classification Results[a,c]				
		Cluster Number of Case	Predicted Group Membership			Total	
			1	**2**	**3**		
Original	**Count**	1	9	4	0	13	
		2	6	34	7	47	
		3	1	0	8	9	
	%	1	69,2	30,8	,0	100,0	
		2	12,8	72,3	14,9	100,0	
		3	11,1	,0	88,9	100,0	
Cross-validated[b]	**Count**	1	8	4	1	13	
		2	9	29	9	47	
		3	2	2	5	9	
	%	1	61,5	30,8	7,7	100,0	
		2	19,1	61,7	19,1	100,0	
		3	22,2	22,2	55,6	100,0	

a. 73,9% of original grouped cases correctly classified.
b. Cross validation is done only for those cases in the analysis. In cross validation, each case is classified by the functions derived from all cases other than that case.
c. 60,9% of cross-validated grouped cases correctly classified.

5.4.3.2 Using the Multiple Lineal Regression method

In this section, and in order to identify the statistical technique that could provide the best results for estimating a model to predict the classification of universities according to their willingness to develop Hard AEA and Soft AEA, a multiple linear regression was applied.

The multiple linear regression analysis is an extension of a simple linear regression to incorporate two or more explanatory variable in a prediction equation for a response variable. Multiple regression analysis is now a mainstay of statistical analysis in most fields because of its power and flexibility. Furthermore, regression is one of the most used econometric methods (Errasti, 2009).

Specifically, the multiple linear regression analysis has the objective of analysing a model that seeks to explain the behaviour of variable Y using information provided

by the values taken by a set of explanatory variables, X_k. The linear model is given as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_k X_k + u$$

Moreover, to develop a multiple linear regression analysis the following assumptions have to be taken into account:

- Independent variables are deterministic (non-random).
- β_k coefficients are the estimated coefficients of the model.
- Variable u (the error) is a random variable with zero mean and a constant covariance matrix and diagonal. The hypothesis of homoscedasticity and autocorrelation are tested.
- Variable Y is random, by relying on the variable u.
- Variables X_1, X_2 ... X_k are linearly independent. The existence of multicollinearity is tested.

Some of these assumptions were analysed within the discriminant analysis; for example, the introduced variables were already tested as normal, linearly independent and non-deterministic. Moreover, homoscedasticity and autocorrelation were tested through the obtained results, after applying the statistical procedure.

Concerning the different inclusion methods that the linear regression allows (e.g. standard, hierarchical and stepwise), the stepwise multiple regression method was applied; since the focus of this method would be the question of what the best combination of independent (predictor) variables would be to predict the dependent (predicted) variable. Indeed, in a stepwise regression, predictor variables are entered into the regression equation one at a time based upon statistical criteria. At each step in the analysis the predictor variable that contributes the most to the prediction equation in terms of increasing the multiple correlation, R, is entered first. This process is continued only if additional variables add anything statistically to the regression equation. When no additional predictor variables add anything statistically meaningful to the regression equation, the analysis stops. Thus, not all predictor variables may enter the equation in stepwise regression.

Thus, variables were introduced stepwise using the F probability with an entry criterion of 0,05 and exit criteria of 0,10; as the step by step method is one of the multi variable regression methods, which choose most effective variable by comparing all independent variable. In this case, so as to analyse both Soft AEA and Hard AEA, this multiple linear regression analysis was used twice, using both as dependent variables.

Hard academic entrepreneurship activities (Hard AEA)

In this case, in order to use this statistical procedure, the dependent variable established was Hard AEA. After applying the selected method, the results showed that two independent variables made up the model: E_CURRI_ACTIVITIES and

INTERNATIONALISATION. In Table 127 are shown the correlation coefficients between the variables, so that it seems that there were not multicollinearity problems. Furthermore, within the regression analysis the variance inflation factors (VIF) was tested (see Table 128 and Table 129), showing a low VIF level; thus the absence of multicollinearity was confirmed.

Table 127 Correlation coefficients for the variables that constitute the final model

		INTERNATIONALISATION	E_CURRI_ACTIVITIES	HARD_AEA
INTERNATION.	Pearson Correlation	1	,428**	,519**
	Sig. (2-tailed)		,000	,000
	N	69	69	69
E_CURRI_ACTIV.	Pearson Correlation	,428**	1	,573**
	Sig. (2-tailed)	,000		,000
	N	69	69	69
HARD_AEA	Pearson Correlation	,519**	,573**	1
	Sig. (2-tailed)	,000	,000	
	N	69	69	69
**. Correlation is significant at the 0,01 level (2-tailed).				

Table 128 and Table 129 show the details of the stepwise regression analysis: The first model could predict the 31,8% of changes in the dependent variable, which predictor variable was just E_CURRI_ACTIVITIES. In the second step, E_CURRI_ACTIVITIES and INTERNATIONALISATION could predict the 40,3% of Hard AEA. Moreover, this results were in 99% certainty ($p < 0,01$). Regarding the significance level of these two variables, both had significance levels between 0,000 and 0,002 for both models. Corresponding to the ANOVA analysis, both models had a significance level of 0,000. Thereby, the existence of a high significance of the coefficients was confirmed.

Analysing the statistics for the model adjustment, both models fit correct determination coefficients (adjusted R^2); consecutively 0,318 and 0,403. These indicate that each model was able to estimate the 31,8% and the 40,3% of the cases, which were considered relatively good values. Moreover, the Durbin-Watson statistic had a value of 1,166 which certifies the absence of residual autocorrelation.

Thus, the mathematical models obtained from this regression analysis were as follow:

$$Y_1 = 1,597 + 0,305 \text{ E\_CURRI\_ACTIVITIES}$$

$$Y_2 = 1,201 + 0,229 \text{ E\_CURRI\_ACTIVITIES} + 0,198 \text{ INTERNATIONALISATION}$$

Table 128 Multiple linear regression analysis for Hard AEA

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	,573[a]	,328	,318	,40762	,328	32,753	1	67	,000	1,166
2	,648[b]	,421	,403	,38147	,092	10,500	1	66	,002	

a. Predictors: (Constant), E_CURRI_ACTIVITIES
b. Predictors: (Constant), E_CURRI_ACTIVITIES, INTERNATIONALISATION
c. Dependent Variable: HARD_AEA

Table 129 Multiple linear regression analysis for Hard AEA (continuation)

	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5,442	1	5,442	32,753	,000[b]
	Residual	11,132	67	,166		
	Total	16,574	68			
2	Regression	6,970	2	3,485	23,948	,000[c]
	Residual	9,604	66	,146		
	Total	16,574	68			

ANOVA[a]

a. Dependent Variable: HARD_AEA
b. Predictors: (Constant), E_CURRI_ACTIVITIES
c. Predictors: (Constant), E_CURRI_ACTIVITIES, INTERNATIONALISATION

Coefficients[a]

	Model	Unstandardised Coefficients		Standardised Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	1,597	,185		8,643	,000		
	E_CURRI_ACTIVITIES	,305	,053	,573	5,723	,000	1,000	1,000
2	(Constant)	1,201	,212		5,680	,000		
	E_CURRI_ACTIVITIES	,229	,055	,429	4,142	,000	,817	1,224
	INTERNATIONALISATION	,198	,061	,336	3,240	,002	,817	1,224

a. Dependent Variable: HARD_AEA

Additionally, as a high R^2 did not guarantee that the model fit the data well (since a high R^2 could occur in the presence of misspecification of the functional form of a relationship or in the presence of outliers that distort the true relationship) it was conducted a visual examination of the residuals to look for obvious deviations from randomness.

Different types of plots of the residuals from a fitted model provide information on the adequacy of different aspects of the model. For this specific case, the sufficiency of the functional part of the model was analysed through scatter plots of residuals versus predictors (see Figure 25). This scatter plot showed the standardised residual against the standardised predicted values, confirming the randomness of the points. Thus, it could be stated that the model is appropriate.
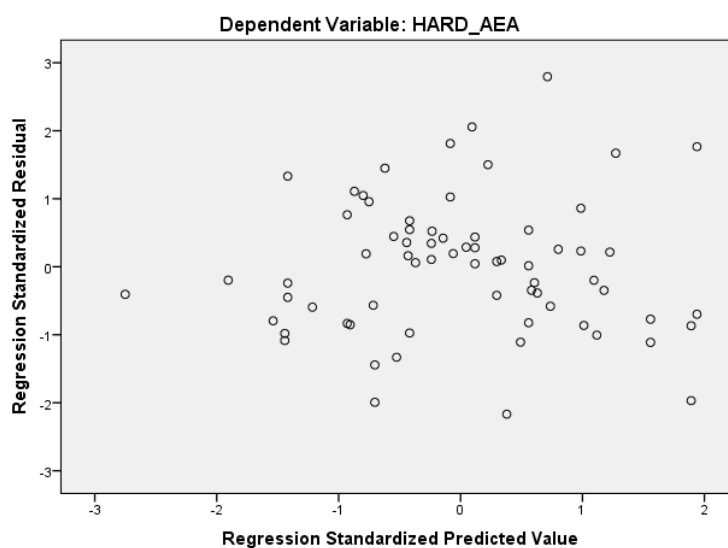
Figure 25 Standardised residuals against standardised predicted values

Soft academic entrepreneurship activities (Soft AEA)

The same statistical procedure was used in order to analyse Soft AEA. After applying the selected method, the results showed that two independent variables made up the model: INDUS_CURRI and POLICIES. In Table 130 are shown the correlation coefficients between the variables, so that there were not going to be multicollinearity problems. Furthermore, within the regression analysis the VIF were tested (see Table 131 and Table 132), showing a low VIF level; thus the absence of multicollinearity was confirmed.

Table 130 Correlation coefficients for the variables that constitute the final model

		POLICIES	INDUS_CURRI	SOFT_AEA
POLICIES	Pearson Correlation	1	,432**	,583**
	Sig. (2-tailed)		,000	,000
	N	69	69	69
INDUS_CURRI	Pearson Correlation	,432**	1	,648**
	Sig. (2-tailed)	,000		,000
	N	69	69	69
SOFT_AEA	Pearson Correlation	,583**	,648**	1
	Sig. (2-tailed)	,000	,000	
	N	69	69	69
**. Correlation is significant at the 0.01 level (2-tailed).				

Table 131 and Table 132 show the details of the stepwise regression analysis. The first model could predict the 41,1% of changes in the dependent variable, which predictor variable was just INDUS_CURRI. In the second step, INDUS_CURRI and POLICIES could predict the 51,8% of Soft AEA. Moreover, this results were in 99% certainty (p<0,01). Regarding the significance level of these two variables, both had significance levels of 0,000 for both models. Corresponding to the ANOVA analysis, both models had a significance level of 0,000. Thereby, the existence of a high significance of the coefficients was confirmed.

Analysing the statistics for the model adjustment, both models fit correct determination coefficients (adjusted R^2); consecutively 0,411 and 0,518. These indicate that each model was able to estimate the 41,1% and the 51,8% of the cases, which were considered relatively good values. Moreover, the Durbin-Watson statistic had a value of 1,080 which certifies the absence of residual autocorrelation. Thus, the mathematical models obtained from this regression analysis were as follow:

$$Y_1 = 1,647 + 0,451 \text{ INDUS\_CURRI}$$

$$Y_2 = 1,283 + 0,339 \text{ INDUS\_CURRI} + 0,202 \text{ POLICIES}$$

Table 131 Multiple linear regression analysis for Soft AEA

Model Summary[c]										
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	,648[a]	,420	,411	,40332	,420	48,487	1	67	,000	1,080
2	,730[b]	,533	,518	,36473	,113	15,925	1	66	,000	

a. Predictors: (Constant), INDUS_CURRI
b. Predictors: (Constant), INDUS_CURRI, POLICIES
c. Dependent Variable: SOFT_AEA

Table 132 Multiple linear regression analysis for Soft AEA (continuation)

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7,887	1	7,887	48,487	,000[b]
	Residual	10,898	67	,163		
	Total	18,786	68			
2	Regression	10,006	2	5,003	37,607	,000[c]
	Residual	8,780	66	,133		
	Total	18,786	68			

a. Dependent Variable: SOFT_AEA
b. Predictors: (Constant), INDUS_CURRI
c. Predictors: (Constant), INDUS_CURRI, POLICIES

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	1,647	,200		8,224	,000		
	INDUS_CURRI	,451	,065	,648	6,963	,000	1,000	1,000
2	(Constant)	1,283	,203		6,329	,000		
	INDUS_CURRI	,339	,065	,487	5,222	,000	,814	1,229
	POLICIES	,202	,051	,372	3,991	,000	,814	1,229

a. Dependent Variable: SOFT_AEA

Additionally, as a high R^2 did not guarantee that the model fit the data well (since a high R^2 could occur in the presence of misspecification of the functional form of a relationship or in the presence of outliers that distort the true relationship) it was conducted a visual examination of the residuals to look for obvious deviations from randomness.

Different types of plots of the residuals from a fitted model provide information on the adequacy of different aspects of the model. For this specific case, the sufficiency of the functional part of the model was analysed through scatter plots of residuals versus predictors (see Figure 26). This scatter plot showed the standardised residual against the standardised predicted values, confirming the randomness of the points. Thus, it could be stated that the model was appropriate.
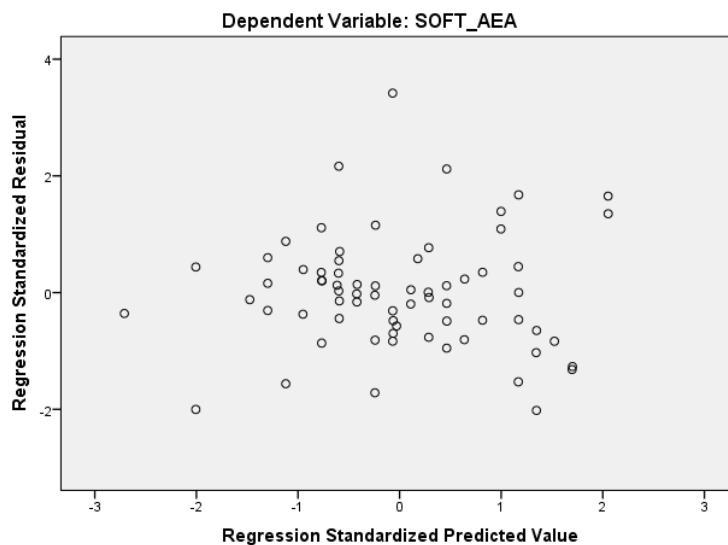
Figure 26 Standardised residuals against standardised predicted values

Thus, after analysing the four estimated models obtained through two different methodologies, the discriminant analysis and the multiple regression, it could be stated that the first analysis had a greater reliability in terms of predictive power than the latter. Indeed, the discriminant model classified correctly the 71% of Hard AEA and the 73,9% of Soft AEA; compared with a 40,3% of Hard AEA and 51,8% of Soft AEA of the model estimated by the multiple regression.

5.5   UNIVERSITIES' TAXONOMY BASED ON ENTREPRENEURIAL UNIVERSITY'S RESULTS

In order to develop a universities' taxonomy depending on Entrepreneurial University's results that really differ from one university to another, the cluster was used again. As it was stated before, the cluster analysis is a technique which aims to group together objects based on a multivariate profile (Hair et al., 1998). So as to carry this out, a combination of hierarchical and non-hierarchical processes was used (Hair et al., 1998, Lévy and Varela, 2003): (i) a hierarchical method (Ward method) was applied with the aim of finding out the number of conglomerates that could be formed in the matrix of data to locate an initial centroid; and then, (ii) the outcome of the hierarchical method was taken as an initial centroid for the non-hierarchical method. The latter helped to adjust or to a greater extent determine the constitution of the conglomerates that were obtained through the employment of the hierarchical method. In this case the k-means method was applied.

Hierarchical method (Ward method): The first step in the cluster analysis was the application of a hierarchical cluster analysis in SPSS to find the agglomerative schedule and proximity matrix for the data obtained on each of the variables (Entrepreneurial University's results) for all the cases. After doing so, the SPSS output provided a proximity matrix which showed the distances (similarity) between all the cases/objects and agglomerative schedule which was used to find the number of clusters present in the data on the basis of fusion coefficients. Furthermore, a dendrogram was obtained. The horizontal axis of the dendrogram represented the distance or dissimilarity between clusters and the vertical axis represented the objects and clusters. Each joining of two clusters was represented on the graph by the splitting of a horizontal line into two horizontal lines. The horizontal position of the split, shown by the short vertical bar, gave the distance (dissimilarity) between the two clusters. Looking at the dendrogram below (see Figure 27), the three clusters or branches that occur at about the same horizontal distance are shown.

Non-hierarchical method (k-means method): The second step in the cluster analysis was the application of the k-means cluster analysis in SPSS. The process was not stopped with the Ward method because of the fact that k-means analysis provided much stable clusters due to interactive procedure involved in it, in comparison to the single-pass hierarchical methods. Then, the case listing of cluster membership was used to describe which case belonged to which cluster. Finally, the ANOVA table described which of the variables were significantly different across all the identified clusters in the problem.
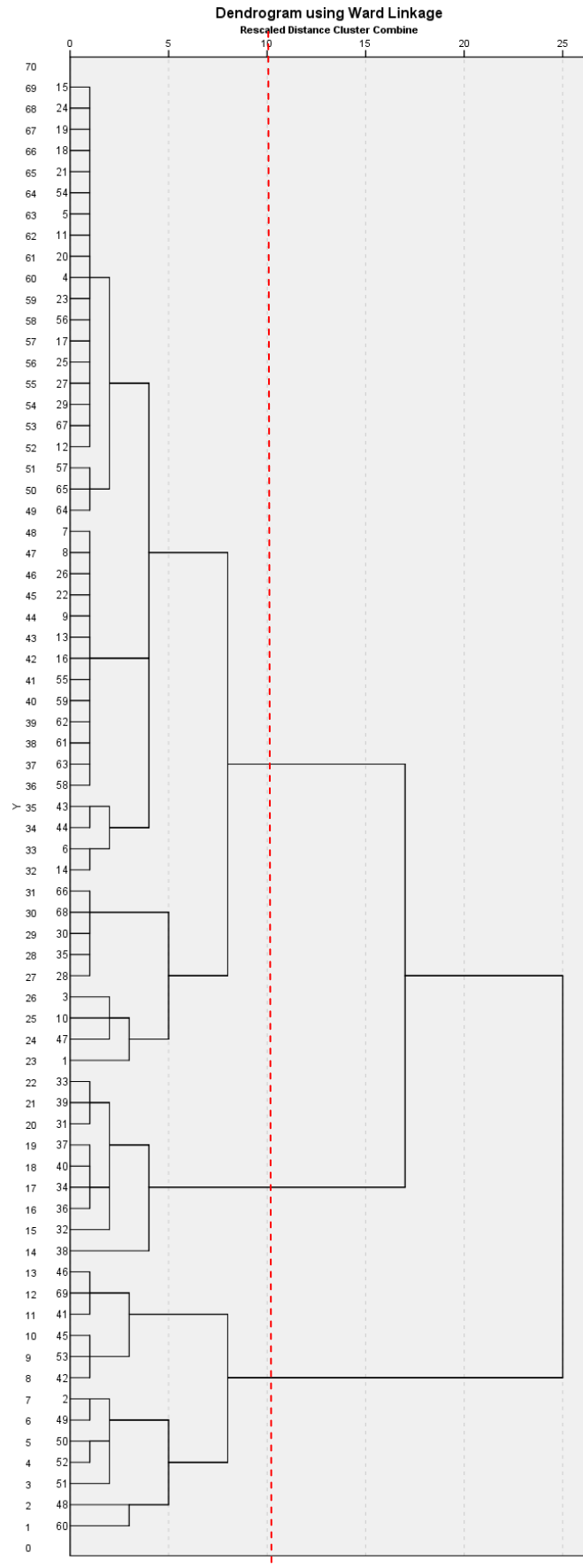
Figure 27 Dendrogram using the Ward method

As a result, the sixty-nine universities were clustered, regarding Entrepreneurial University's results, into three different groups: Cluster 1 composed by fourteen universities (high values in Soft AEA and on the mean in Hard AEA), Cluster 2 composed by ten universities (low values in all Entrepreneurial University's results) and Cluster 3 composed by forty-five universities (on the mean in all Entrepreneurial University's results) (see Graph 19).
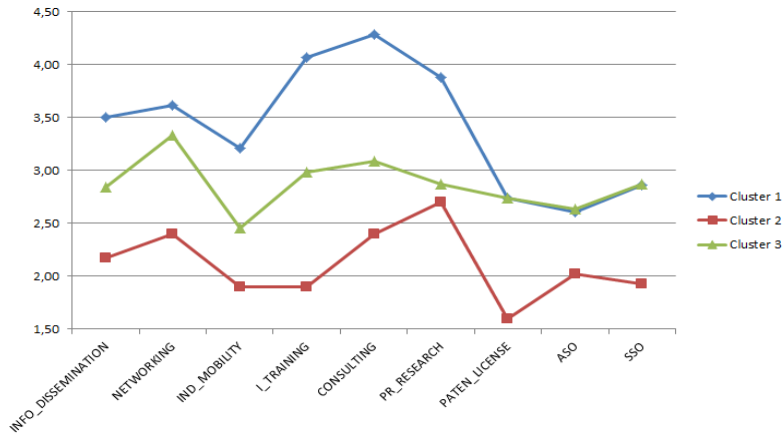
Graph 19 Entrepreneurial University's results of the three clusters

Afterwards, an ANOVA analysis was developed in order to confirm the difference between the three clusters regarding Entrepreneurial University's results. Thus, through a comparison of means (see Table 133) the rejection of the null hypothesis of equal means is shown.

Table 133 ANOVA analysis of Entrepreneurial University's results for the three clusters

		Sum of Squares	df	Mean Square	F	Sig.
		ANOVA				
INFO_DISSEMINATION	Between Groups	10,525	2	5,262	22,187	,000
	Within Groups	15,654	66	,237		
	Total	26,178	68			
NETWORKING	Between Groups	9,421	2	4,710	18,447	,000
	Within Groups	16,853	66	,255		
	Total	26,273	68			
I_TRAINING	Between Groups	28,063	2	14,032	40,607	,000
	Within Groups	22,806	66	,346		
	Total	50,870	68			
IND_MOBILITY	Between Groups	10,691	2	5,345	22,335	,000
	Within Groups	15,795	66	,239		
	Total	26,486	68			
CONSULTING	Between Groups	23,388	2	11,694	36,926	,000
	Within Groups	20,902	66	,317		
	Total	44,290	68			
PR_RESEARCH	Between Groups	12,263	2	6,131	17,057	,000
	Within Groups	23,725	66	,359		
	Total	35,987	68			
PATENT_LICENSE	Between Groups	11,066	2	5,533	28,547	,000
	Within Groups	12,792	66	,194		
	Total	23,857	68			
ASO	Between Groups	3,268	2	1,634	5,841	,005
	Within Groups	18,464	66	,280		
	Total	21,732	68			
SSO	Between Groups	7,547	2	3,773	13,897	,000
	Within Groups	17,921	66	,272		
	Total	25,467	68			

Once the differences between groups' means were demonstrated, the means of the Entrepreneurial University's results for each cluster were analysed (data previously shown in (Graph 19). Cluster 2 obtained the worst values on all Entrepreneurial University's results, except for PR_RESEARCH, variable that was in the same level of Cluster 3. Regarding Cluster 1, these were the universities that obtain the highest values on Soft AEA and were in the same level of Cluster 3 regarding Hard AEA. Finally, Cluster 3 was on the mean on all Entrepreneurial University's results.

Based on these three clusters it was interesting to analyse their differences regarding the entrepreneurship support mechanisms in order to identify the main mechanisms that leading universities had for Entrepreneurial University's results promotion. To achieve this objective, an ANOVA was performed (see Table 134); which shown all p-values under the threshold 0,005, falling to reject the null hypothesis.

Table 134 ANOVA analysis of entrepreneurship support mechanisms for the three clusters

	ANOVA					
		Sum of Squares	df	Mean Square	F	Sig.
POLICIES	Between Groups	23,753	2	11,876	19,570	,000
	Within Groups	40,053	66	,607		
	Total	63,806	68			
INDUS_CURRI	Between Groups	9,998	2	4,999	11,493	,000
	Within Groups	28,706	66	,435		
	Total	38,704	68			
INTERNATIONALISATION	Between Groups	13,128	2	6,564	12,545	,000
	Within Groups	34,535	66	,523		
	Total	47,663	68			
E_FUNDS	Between Groups	5,213	2	2,607	3,489	,036
	Within Groups	49,305	66	,747		
	Total	54,518	68			
E_EDUCATION	Between Groups	7,058	2	3,529	4,758	,012
	Within Groups	48,950	66	,742		
	Total	56,007	68			
METHODS	Between Groups	5,848	2	2,924	4,835	,011
	Within Groups	39,913	66	,605		
	Total	45,761	68			
E_CURRI_ACTIVITIES	Between Groups	15,155	2	7,578	11,563	,000
	Within Groups	43,251	66	,655		
	Total	58,407	68			
E_STAFF	Between Groups	12,013	2	6,007	7,050	,002
	Within Groups	56,230	66	,852		
	Total	68,243	68			

Once the differences between groups' means were demonstrated, the means of the entrepreneurship support mechanisms for each cluster were analysed (see Graph 20). As it is shown in the figure below, Cluster 2 obtained the worst values on all entrepreneurship support mechanisms which agreed with the results on Entrepreneurial University's results, considering that this group of universities had the lower values on Entrepreneurial University's results. Regarding Cluster 1, the best universities as to Soft AEA, obtained the highest results on almost all entrepreneurship support mechanisms, except for E_CURRI_ACTIVITIES & E_STAFF. Finally, Cluster 3 showed better results on E_CURRI_ACTIVITIES & E_STAFF than Cluster 1 although their results on Soft AEA were worst.
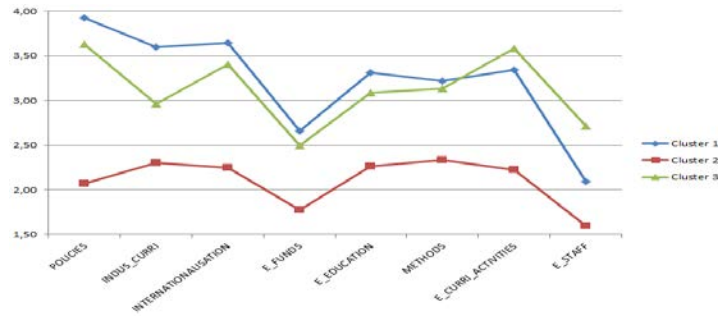
Graph 20 Entrepreneurship support mechanisms level of the three clusters

It is worth highlighting that the universities that obtained higher values on Soft AEA (Cluster 1) were the ones that promote more POLICIES, INDUS_CURRI, INTERNATIONALISATION, E_FUNDS and E_DUCATION. On the other hand, universities which were on the mean regarding all Entrepreneurial University's results (Cluster 3) promoted more E_CURRI_ACTIVITIES and E_STAFF. Finally, mention that Cluster 2 was the group of universities that obtained the worst values on both Entrepreneurial University's results and entrepreneurship support mechanisms.

Afterwards, in order to analyse the differences between the universities that obtained better results on Soft AEA, it was necessary to compare Cluster 1 and Cluster 2; since both obtained similar results on Hard AEA, although they had big differences on Soft AEA. Thus, in order to analyse if there was any significant difference, the Student's *t*-test was performed. The results are shown in Table 135.

Table 135 Student's *t*-test for independent samples applied to entrepreneurship support mechanisms in relation to Cluster 1 and Cluster 3

	Levene's Test for Equality of Variances		t-test for Equality of Means						
								95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
POLICIES									
Equal variances assumed	2,746	,103	1,222	57	,227	,30213	,24729	-,19305	,79731
Equal variances not assumed			1,451	30,16(	,157	,30213	,20822	-,12301	,72727
INDUS_CURRI									
Equal variances assumed	1,734	,193	3,103	57	,003	,63600	,20495	,22559	1,04641
Equal variances not assumed			2,650	17,65!	,016	,63600	,24004	,13099	1,14101
INTERNATION.									
Equal variances assumed	,785	,379	1,055	57	,296	,24019	,22762	-,21562	,69600
Equal variances not assumed			,980	19,53(	,339	,24019	,24501	-,27167	,75205
E_FUNDS									
Equal variances assumed	,347	,558	,597	57	,553	,16240	,27184	-,38195	,70675
Equal variances not assumed			,570	20,27(	,575	,16240	,28483	-,43124	,75603
E_EDUCATION									
Equal variances assumed	,050	,824	,840	57	,405	,21973	,26167	-,30426	,74372
Equal variances not assumed			,903	24,60(	,375	,21973	,24325	-,28167	,72113
METHODS									
Equal variances assumed	1,182	,282	,322	57	,748	,07927	,24595	-,41323	,57177
Equal variances not assumed			,284	18,29(	,780	,07927	,27905	-,50631	,66485
E_CURRI_ACTIVITIES									
Equal variances assumed	,249	,620	-,991	57	,326	-,24671	,24886	-,74505	,25162
Equal variances not assumed			-,968	20,95:	,344	-,24671	,25484	-,77676	,28333
E_STAFF									
Equal variances assumed	,129	,721	-2,257	57	,028	-,61495	,27243	-1,16048	-,06943
Equal variances not assumed			-2,274	21,98:	,033	-,61495	,27041	-1,17578	-,05413

Note that the Levene statistic had an associated p-value greater than the critical significance level of 0,05, thus the assumption of equal variances (the property holds homoscedasticity of variance) was assumed in all cases. However, the statistical t value was less than the critical value of 0,05 for only two entrepreneurship support mechanisms (INDUS_CURRI and E_STAFF), rejecting the null hypothesis of equal means. Thus it could be concluded that universities which obtain high results on Soft AEA (Cluster 1) obtained better results on INDUS_CURRI; and on the other hand, universities from Cluster 3, obtained better results on E_STAFF (see Table 136).

Table 136 Means of entrepreneurship support mechanisms in relation to Cluster 1 and Cluster 3

	Cluster Number	N	Mean	Std. Deviation	Std. Error Mean
POLICIES	1	14	3,9286	,61532	,16445
	3	45	3,6264	,85675	,12772
INDUS_CURRI	1	14	3,6000	,83020	,22188
	3	45	2,9640	,61434	,09158
INTERNATIONALISATION	1	14	3,6429	,82459	,22038
	3	45	3,4027	,71820	,10706
E_FUNDS	1	14	2,6593	,94897	,25362
	3	45	2,4969	,86956	,12963
E_EDUCATION	1	14	3,3093	,76666	,20490
	3	45	3,0896	,87950	,13111
METHODS	1	14	3,2157	,95596	,25549
	3	45	3,1364	,75283	,11222
E_CURRI_ACTIVITIES	1	14	3,3393	,84129	,22484
	3	45	3,5860	,80473	,11996
E_STAFF	1	14	2,0957	,88069	,23537
	3	45	2,7107	,89301	,13312

Finally, it was interesting to analyse the characteristics of each cluster regarding environmental external and organisational internal factors. Therefore, an ANOVA was performed (see Table 137); which show all p-values under the threshold 0,005, falling to reject the null hypothesis.

Table 137 ANOVA analysis of environmental external and organisational internal factors for the three clusters

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
INST_CONTEXT	Between Groups	9,388	2	4,694	11,332	,000
	Within Groups	27,338	66	,414		
	Total	36,726	68			
INDUS_CONTEXT	Between Groups	7,565	2	3,783	7,350	,001
	Within Groups	33,966	66	,515		
	Total	41,532	68			
STRATEGY	Between Groups	10,723	2	5,361	8,284	,001
	Within Groups	42,717	66	,647		
	Total	53,439	68			
MANAG_SUPPORT	Between Groups	10,497	2	5,249	10,727	,000
	Within Groups	32,292	66	,489		
	Total	42,790	68			
ORGANI_DESIGN	Between Groups	7,530	2	3,765	7,834	,001
	Within Groups	31,722	66	,481		
	Total	39,253	68			

Once the differences between groups' means were demonstrated, the means of the environmental external and organisational internal factors for each cluster were analysed (see Graph 21). As it is shown in the figure below, Cluster 2 obtained the worst values on all environmental external and organisational internal factors

which agreed with the results on Entrepreneurial University's results, considering that this group of universities had the lower values on Entrepreneurial University's results. Regarding Cluster 1, the best universities as to Soft AEA, obtained the highest results on all environmental external and organisational internal factors and finally, Cluster 3 showed good results on all environmental external and organisational internal factors; although not as good as Cluster 1.
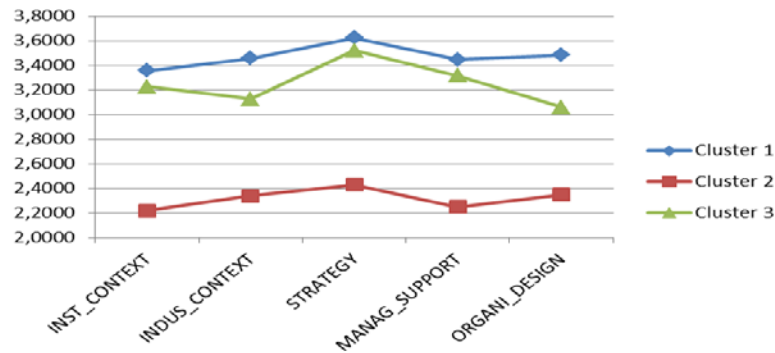
Graph 21 Environmental external and organisational internal factors' level of the three clusters

5.6   RESULTS AND FINDINGS

After developing the data analysis, the next step was to analyse the results and findings obtained in order to contrast the hypotheses and objectives defined in previous chapters.

From this baseline and in order to achieve the main objective, three specific objectives and its consecutive hypotheses were drawn (see Table 37 in Chapter 4); a total of ten hypotheses. In addition, through the general analysis of the sample, interesting results were obtained regarding the geographical location, the ownership status and the ownership of an engineering faculty. Thereby, this section collects the objective results regarding these three intrinsic characteristics, as well as the main results of each hypothesis drawn from the data analysis.

Thus, continuing the order established for the data analysis, first the results regarding the three intrinsic characteristics are shown and then the hypothesis testing is done.

5.6.1   Results from the sample analysis

In the recent years, a number of papers have shown that the Entrepreneurial University is influenced by its intrinsic characteristics, including the geographical location (e.g. Klofsten and Jones-Evans (2000), Lockett et al. (2003), Shane (2004a) and Bratianu and Stanciu (2010)), the ownership status (e.g. Adams and Griliches (1998), Lach and Schankerman (2008), Belenzon and Schankerman (2009) and Closs et al. (2012)) and the ownership of an engineering faculty (e.g. Baldini et al. (2007) and Caldera and Debande (2010)). Thereby, a descriptive analysis and its consecutive contrast were developed for each of these variables, achieving

interesting results which are worked out in the following lines.

Regarding the geographical location, although the field is quite international, most studies to date focus on analysing Entrepreneurial Universities from the United States and selected European countries (Rothaermel et al., 2007). In fact, only a few studies, e.g. Jones-Evans (1998), Etzkowitz et al. (2000), Klofsten and Jones-Evans (2000) and Mowery and Sampat (2005), compared or/and contrasted Entrepreneurial University's results across different countries (Rothaermel et al., 2007). Furthermore, in addition to cultural differences across countries, studies regarding Entrepreneurial University's intrinsic institutional characteristics need to be addressed (e.g. public institutions versus private institutions or technological institutions versus business institutions).

In this specific case, the analysed universities were from different countries within Europe. Indeed, almost half of the sample was from Spain (due to the proximity of the researcher to Spanish universities) and the rest were from nineteen different European countries. Due to the equilibrium of both samples, and in order to analyse the previous statements, it was seem interesting to compare them. The main differences between these two groups were on entrepreneurship support mechanisms, since Spanish universities promotes less INDUS_CURRI, E_FUNDS, E_EDUCATION and METHODS than the rest of European universities. Besides, as to Entrepreneurial University's results SSO was the only Entrepreneurial University's result that was significantly different for both groups. In fact, the rest of European universities generated more SSO than Spanish.

Moving on to analyse the differences between public and private universities (the ownership status), they only had significant differences in PATENT_LICENSE and ASO; specifically, public universities obtained better results on both PATENT_LICENSE and ASO than private universities. Regarding entrepreneurship support activities, there were not found significant differences between both groups. These results are rejected by various authors hypothesis, such as Adams and Griliches (1998) and Siegel et al. (2003), who showed that private universities achieved better performance in terms of technology transfer activity. Furthermore, Belenzon and Schankerman (2009) found that the ownership status of a university did not affect licensing performance.

Regarding university's technical orientation, many authors (e.g. Baldini et al. (2007) Calderini et al. (2009) and Caldera and Debande (2010)) highlighted that this intrinsic characteristic is expected to influence universities' performance, since universities specialised in fields like biotechnology or technical sciences are more likely to generate valuable research output for the business sector than universities specialised in social sciences. Besides, Closs et al. (2012) highlight there is a higher number of patent and license registrations from universities that run an engineering faculty. In this line and out of accord with the previous authors, results showed that universities which possess an engineering faculty obtained better results on IND_MOBILITY and CONSULTING. In fact, these two Entrepreneurial University's results could be classified as Soft AEA, reinforcing the theory that universities specialised in technical sciences are more likely to generate valuable research output for industry; although it is not through patent

and license registrations. Regarding entrepreneurship support mechanisms, results demonstrated that the universities specialised in technical sciences developed more E_CURRI_ACTIVITIES than the rest.

5.6.2 Results from the hypotheses testing

Through this section the established hypotheses are tested one by one, analysing the research results obtained in the previous sections.

H1. *Environmental external factors influence positively and significantly on Entrepreneurial University's results.*

> This hypothesis was rejected, since environmental external factors did not show a significantly direct influence on Entrepreneurial University's results. Although diverse authors stated that an appropriate external environment stimulates or facilitates the entrepreneurial activity, this research showed that it was not a direct relationship between them. Nevertheless, due to the importance of environmental external factors within the literature, the Entrepreneurial University's model was adapted and the indirect impact of this factor was analysed. In fact, this second model showed that environmental external factors influenced positively and significantly on both internal organisational factors and entrepreneurship support mechanisms; which, in turn, had a positive and significant relationship with Entrepreneurial University's results.

H2. *Internal organisation factors influence positively and significantly on Entrepreneurial University's results.*

> The same happened with the relationship between internal organisational factors and Entrepreneurial University's results, since there was not found a significant relationship between them. However, due to the importance that organisational internal factors had in the literature, the indirect impact of this factor was analysed in a subsequent model. This new model showed a positive and significant relationship between internal organisational factors and entrepreneurship support mechanisms; thereby, an indirect relationship between organisational factors and Entrepreneurial University's results, through entrepreneurship support mechanisms, was identified.

As just showed through the previous two hypotheses, nor external environmental factors neither internal organisational factors had a direct influence on Entrepreneurial University's results; however the second model tested showed that in an indirect way, through internal organisational factors and entrepreneurship support mechanisms, their presence was important. Due to this fact, it was necessary to analyse deeply the effect of the external environment and internal organisational factors on entrepreneurship support mechanisms; getting into the factors that built these two variables.

First of all, the influence of both INST_CONTEXT and INDUS_CONTEXT were analysed. On the one hand, regarding the first factor, the results showed that universities with a higher INST_CONTEXT invest more on all the entrepreneurship support mechanisms. This analysis corroborated the previous results which showed the positive link between environmental external factors and entrepreneurship support mechanisms. On the other hand, universities with a higher INDUS_CONTEXT invest more on all the entrepreneurship support mechanisms, except on E_CURRI_ACTIVITIES. This shows that universities within a support industrial context are less focused on providing support through the whole entrepreneurship process. Furthermore, this fact could drive the university to seek Soft AEA; instead of promoting Hard AEA.

Then, the influence of the factors that composed the internal organisation were analysed: STRATEGY, MANAG_SUPPORT and ORGANI_DESIGN. As it was shown through the literature review (see Section 2.1), to establish a specific strategy in order to promote the third mission within the university is the only factor that all authors agreed as the core element of an Entrepreneurial University (see Table 14). According to this fact, the analysis showed that universities with an established entrepreneurial strategy obtain significantly higher results on all entrepreneurship support mechanisms. Regarding the management support, it was another core factor within the path towards the Entrepreneurial University; since a dynamic management structure was essential for an institutional transformation. In the same line, the analysis showed that universities with a supportive management team obtain significantly higher results on all entrepreneurship support mechanisms than the rest, except on E_STAFF. This means that there is not a significant relationship between the organisational design of a university and the development of their staff on entrepreneurship.

H3. Entrepreneurship support mechanisms influence positively and significantly on Entrepreneurial University's results.

> Regarding the influence of entrepreneurship support mechanisms on Entrepreneurial University's results, it was identified a positive significant relationship between them. Through the tested model, the entrepreneurship support mechanisms were analysed as a whole and comparing with the previous two factors (external environment and internal organisation), this third link was the only significant.

> Therefore, entrepreneurship support mechanisms are the core factors within an Entrepreneurial University.

H4. Universities that promote more entrepreneurship support mechanisms obtain higher values on Entrepreneurial University's results than the rest.

> According to the results obtained through the analysis (Section 5.4) and corroborating the results obtained through the PLS-SEM technique, there is significant and positive relationship between entrepreneurship support mechanisms and Entrepreneurial University's results. Indeed, universities

that obtain better Entrepreneurial University's results, are the ones that promote more entrepreneurship support mechanisms.

H5. *Universities engage with an incubator obtain better results on Entrepreneurial University's results than the rest.*

Based on the empirical findings available in the literature, Entrepreneurial Universities seek to create incubators in order to provide support for the creation of spin-off firms and to aid academics in the commercialisation of their research. In this line, based on the obtained results, universities with an incubator obtain better results only on IND_MOBILITY, CONSULTING, PATENT_LICENSE, ASO and SSO than the rest of universities. These are really interesting results, since the importance of incubators on Hard AEA development is corroborated. Furthermore, consulting and mobility are also significantly and positively related to the possession of an incubator.

H6. *Universities engage with a technology park obtain better results on Entrepreneurial University's results than the rest.*

In recent years, there has been a substantial increase in investment in technology parks in order to facilitate technology transfer. Indeed, many universities have established technology parks so as to foster the creation of spin-off firms based on university-owned (or licensed) technologies. Completely aligned to this statement, results showed that universities with a technology park obtain better results on PATENT_LICENSE and SSO than the rest.

H7. *Universities which obtain higher values on Hard AEA have significantly higher values on some specific entrepreneurship support mechanisms.*

An individual analysis to measure if universities with higher values on Hard AEA have significantly higher results on some specific entrepreneurship support mechanisms was done. The obtained results showed that this statement is true, since universities that obtained better Hard AEA results promote more all entrepreneurship support activities except INDUS_CURRI. In other words, universities that do not have any support from industry for curriculum development and delivery obtain better results on Hard AEA.

H8. *Universities which obtain higher values on Soft AEA have significantly higher values on some specific entrepreneurship support mechanisms.*

In order to prove this hypothesis the same analysis as for H7 was developed and the obtained results showed that universities which obtain higher values on Soft AEA have significantly higher results on all entrepreneurship support mechanisms, except on E_STAFF. In this line, it could be stated that due to the high UBC that this type of universities develop, they are not

worried about promoting Hard AEA; thereby, this universities do not invest on staff development in entrepreneurship.

H9. *Universities that pursue Soft AEA have developed different entrepreneurship support mechanisms from the ones that pursue Hard AEA.*

According to the latter two hypotheses, it seemed that there are differences regarding entrepreneurship support mechanisms in universities that foster more Soft AEA and the ones that foster Hard AEA. In fact, in line with the previous conclusions, universities that pursuit Soft AEA promote significantly more INDUS_CURRI and less E_STAFF than the ones that promote Hard AEA.

H10. *Universities that are above the mean regarding Hard AEA, are the ones that obtain the worse values on Soft AEA.*

According to the results obtained through the cluster analysis, universities could be classified into three groups regarding their Entrepreneurial University's results:

- Cluster 1: High values on Soft AEA and medium values on Hard AEA.
- Cluster 2: Medium values on Soft AEA and medium on Hard AEA.
- Cluster 3: Low values on Soft AEA and low values on Hard AEA.

From this baseline, the previous hypothesis is rejected; since the universities that are above the mean regarding Hard AEA, also obtain good results on Soft AEA.

5.7   SUMMARY

In this chapter various statistical techniques and procedures were used in order to achieve the objectives proposed in Chapter 4 and its consecutive hypotheses. As mentioned at the beginning of the present chapter, the first step developed was the data analysis so as to ensure the reliability of the data obtained and the reliability of the scale used; avoiding, as far as possible, problems caused by poorly transcribed data or other typical problems in data collection. Moreover, the adequacy of the measurements was ensured to avoid misinterpretation of the results.

After ensuring that both data and the measurement scale were right, universities characterisation was done. First of all analysing a series of descriptive variables of the sample; and then, focusing on three specific variables: the location, the ownership status and the possession of an engineering faculty. Regarding the location, the sample was divided into two groups, Spanish and the rest of European universities; with respect to the ownership status, universities were classified depending if they were public or private; and finally, regarding the possession of an engineering faculty, universities were classified as to their possession of an engineering faculty or not.

Once the descriptive part was developed, the data analysis was proceeded in order to respond to the research objectives and hypotheses. A summary of the results obtained through this chapter are shown in tables below (see Table 138, Table 139 and Table 140), which correspond to the established targets.

Table 138 Research hypotheses and results regarding the first objective

Specific Objective 1	*To analyse the relationships between external environmental factors, internal organisational factors, entrepreneurship support mechanisms and Entrepreneurial University's results.*	
Sub-objective 1.1	To analyse the relationship between external environmental factors and Entrepreneurial University's results.	
Hypothesis 1	Environmental external factors influence positively and significantly on Entrepreneurial University's results.	
Result	Environmental external factors don't have any direct influence on Entrepreneurial University's results.	**Rejected**
Sub-objective 1.2	To analyse the relationship between internal organisation factors and Entrepreneurial University's results.	
Hypothesis 2	Internal organisation factors influence positively and significantly on Entrepreneurial University's results.	
Result	Organisational internal factors don't have any direct influence on Entrepreneurial University's results.	**Rejected**
Sub-objective 1.3	To analyse the relationship between Entrepreneurship support mechanisms and Entrepreneurial University's results.	
Hypothesis 3	Entrepreneurship support mechanisms influence positively and significantly on Entrepreneurial University's results.	
Result	Entrepreneurship support mechanisms influence positively Entrepreneurial University's results.	**Confirmed**

Table 139 Research hypotheses and results regarding the second objective

Specific Objective 2	To analyse the impact of Entrepreneurship support mechanisms on Entrepreneurial University's results.	
Sub-objective 2.1	To describe the impact of entrepreneurship support mechanisms Entrepreneurial University's results.	
Hypothesis 4	Universities that promote more entrepreneurship support mechanisms obtain higher values on Entrepreneurial University's results than the rest.	
Result	Universities that obtain higher results on Entrepreneurial University's results, promote more entrepreneurship support mechanisms than the rest.	**Confirmed**
Hypothesis 5	Universities engage with an incubator obtain higher Entrepreneurial University's results than the rest.	
Result	Universities with an Incubator obtain better results on IND_MOBILITY, CONSULTING, PATENT_LICENSE, ASO and SSO than the rest.	**Partially confirmed**
Hypothesis 6	Universities engage with a technology park obtain higher Entrepreneurial University's results than the rest.	
Result	Universities with a Technology Park obtain better results on PATENT_LICENSE and SSO than the rest.	**Partially confirmed**
Sub-objective 2.2	To analyse the impact of entrepreneurship support mechanisms on Hard Entrepreneurial University's results.	
Hypothesis 7	Universities which obtain higher values on Hard AEA have significantly higher results on some specific entrepreneurship support mechanisms.	
Result	Universities which obtain higher values on Hard AEA have significantly higher results on all entrepreneurship support mechanisms, except on INDUS_CURRI.	**Confirmed**
Sub-objective 2.3	To analyse the impact of Entrepreneurship support mechanisms on Soft Entrepreneurial University's results.	
Hypothesis 8	Universities which obtain higher values on Soft AEA have significantly higher results on some specific entrepreneurship support mechanisms.	
Result	Universities which obtain higher values on Soft AEA have significantly higher results on all entrepreneurship support mechanisms, except on E_STAFF.	**Confirmed**
Sub-objective 2.4	To estimate a predictive model and identify the most critical factors which must be influenced in order to evolve a university from their current scenario in Entrepreneurial University's results to a superior one.	
Result	Through discriminant analysis both estimated models, for Soft AEA and Hard AEA, obtain a higher prediction power (71% and 73,9%, consecutively) than through the regression analysis.	

Table 140 Research hypotheses and results regarding the third objective

Specific Objective 3	To develop a Universities' taxonomy depending on Entrepreneurial University's results	
Hypothesis 9	Universities that pursue Soft AEA have developed different Entrepreneurship support mechanisms from the ones that pursue Hard AEA.	
Result	Universities that pursue Soft AEA promote significantly more INDUS_CURRI and less E_STAFF than the ones that promote Hard AEA.	**Confirmed**
Hypothesis 10	Universities that are above the mean regarding Hard AEA, are the ones that obtain the worse values on Soft AEA.	
Result	Universities that are above the mean regarding Hard AEA also obtain good results on Soft AEA.	**Rejected**

Chapter 6

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Conclusions and recommendations

6. CONCLUSIONS AND RECOMMENDATIONS

Through this last chapter the final conclusions and recommendations are shown. First of all, a brief summary of the thesis is developed, which highlights the main points of the whole research. Afterwards, a discussion regarding the three specific objectives is done, based on the empirical analysis previously developed, which lead to the conclusions section. In the third section of the chapter the research contributions are shown. And finally, the last two sections deal with research limitations and future research lines that this thesis proposes.

6.1   SUMMARY AND FINAL REMARKS

Innovation and entrepreneurship are providing a way forward to the current society, which is facing global challenges that extend well beyond the economy (Volkmann et al., 2009). Entrepreneurship is a wide concept that is observed on several scenarios, such as from academia. In fact, university is considered a societal change agent and a relevant instrument in the facilitation of the contemporary knowledge based economy; since its support to the generation and exploitation of knowledge through its three missions: education, research and economic and social development (Etzkowitz, 2003c).

Due to this fact, university is experimenting several cultural, educational, institutional and legislative challenges in order to face up the global competitive environment (Guerrero and Urbano, 2010); giving rise to create the Entrepreneurial University. This transformation is not surprising, because since its creation the university has evolved covering societies' necessities and adapting its missions to them (Etzkowitz, 2003c). Thus, the Entrepreneurial University has become an instrument that not only fosters the creation and transformation of knowledge, but also works on individual's values and attitudes (Guerrero and Urbano, 2010).

In the recent years, the Entrepreneurial University has become a potential research area in order to understand the most relevant factors to promote Entrepreneurial University's results (Clark, 1998, Sporn, 2001, Etzkowitz, 2004, Guerrero and Urbano, 2010); however, there is no consensus on what constitutes an Entrepreneurial University. There is not a unified definition or neither a set of characteristics that describe the Entrepreneurial University itself. Due to this fact, the objective of this thesis was to develop an empirical-institutional analysis of the factors that affects the Entrepreneurial University. With this aim, a literature review on Entrepreneurial Universities was done, analysing the definitions, characteristics, frameworks and empirical research studies related to the domain;

confirming the absence of consensus regarding a unified definition or an established set of characteristics of the Entrepreneurial University, a validated model and an approved measurement indicators.

Therefore, the first research challenge within this thesis was to clarify how an Entrepreneurial University is made up. From this baseline, in Chapter 2 diverse information sources were analysed in order to solve this lack. Concretely, Entrepreneurial University definitions, characteristics, frameworks and empirical studies were reviewed in order to achieve the objective. As a result, fifteen factors, classified within external environment factors, internal organisation factors and entrepreneurship support mechanisms were identified as the ones that universities should pay more attention to transform into Entrepreneurial Universities.

The second research challenge was to measure the Entrepreneurial University. From the literature review, two different currents were identified regarding this issue: on the one hand, some authors (e.g. Clark (1998), Sporn (2001), Etzkowitz (2004), Hindle (2010), Peterka (2011), European Commission (2012) and Mavi (2014)) measured the Entrepreneurial University using the factors that made it up as indicators; and on the other hand, other group of authors (e.g. Guerrero and Urbano (2010) and Sooreh et al. (2011)) described some specific indicators for measuring universities' missions. Based on the second current, a set of nine indicators was established as Entrepreneurial University's results. Indeed, these indicators were academic entrepreneurship activities; since these are the mechanisms that improve the regional or national economic performance, as well as university's performance (Etzkowitz et al., 2000, Philpott et al., 2011).

Continuing in this vein, a high number of authors worked on identifying the different academic entrepreneurship activities, such as Louis et al. (1989), Brennan et al. (2005), Brennan and McGowan (2006), Kim (2008), Wright et al. (2008) and Philpott et al. (2011) (see Section 2.2). Besides, these activities could be classified depending on their impact on the economic and social development (Kim, 2008, Philpott et al., 2011); naming as Hard academic entrepreneurship activities (Hard AEA) the ones that impact directly on the economic and social development and as Soft academic entrepreneurship activities (Soft AEA) the ones that achieve it indirectly. Thereby, the nine academic entrepreneurship activities or Entrepreneurial University's results were classified into these two groups.

Another research challenge to be solved was the low number of empirically tested Entrepreneurial University models (Teh and Yong, 2008, Guerrero and Urbano, 2010, Peterka, 2011), which caused a lack of a referent model. To solve this gap and identify suitable models, it was necessary to study a more evolved entrepreneurship research stream, such as the corporate entrepreneurship. In fact, Covin and Slevin (1991)'s corporate entrepreneurship model was established as the most appropriate model for analysing the Entrepreneurial University phenomenon; since authors such as Brennan and McGowan (2006) stated that there was a lack of attention given to the institutional context within the Entrepreneurial University; suggesting a corporate view of entrepreneurship within the university.

Therefore, bringing together the previously identified Entrepreneurial University's factors as inputs and the Entrepreneurial University's results as outputs, within Covin and Slevin (1991)'s model, an Entrepreneurial University model was built (see Chapter 3). Once the model was established and the main objectives were clear (see Section 4.1), ten hypotheses were stated (see Section 4.2) in order to achieve the objectives. The next step was to analyse empirically the model, in order to corroborate it. Thus, as it was shown in Chapter 4, an institutional-level quantitative research with an emailed survey based on a self-devised questionnaire was followed; contacting with European universities.

Based on the gathered data (a total of sixty-nine European universities), the empirical analysis was developed (see Chapter 5). In fact, the statistical analysis for this thesis included reliability analysis, EFA, descriptive statistics, independent samples *t*-test, ANOVA, cluster analysis, discriminant function analysis, multiple linear regression and PLS-SEM. It is important to highlight the use of the latter technique, the PLS-SEM, since it was a new approach in Entrepreneurial University research.

Following in this vein, PLS-SEM was applied in order to test the Entrepreneurial University model (see Chapter 5.3). In fact, this technique was used since it enabled the simultaneous testing of the structural component and the measurement component in one model (Esposito Vinzi et al., 2010), and with small sample sizes (Chin and Newsted, 1999, Hair et al., 2013). Thereby, based on this approach and taking into account the importance that both external environmental and internal organisational factors had on the Entrepreneurial University (Rasmussen et al., 2012), their direct and indirect impact were analysed.

In fact, external environment is intended to include those forces and elements external to universities' boundaries that affect the organisation (Covin and Slevin, 1991) and internal organisational factors contribute in enabling and stimulating the Entrepreneurial University's results (Etzkowitz, 2003c, Brennan et al., 2005, Brennan and McGowan, 2006, Clarysse et al., 2011, Yusof et al., 2012). However, results showed that there were not significant relationships neither between external environment and Entrepreneurial University's results, nor between internal organisation and Entrepreneurial University's results (see Section 5.3.1).

Thus, the next approach was to analyse the indirect impact of both external and internal factors on Entrepreneurial University's results. In order to test these relationships a second Entrepreneurial University model was developed (see Section 5.3.2), which showed that both external and internal factors had a positive and significant impact on entrepreneurship support mechanisms; influencing Entrepreneurial University's results in an indirect way. Furthermore, a significant relation between external and internal factors was found; specifically, external factors influence positively on internal factors.

This first approach provides insight regarding the importance of the influence of external and internal factors on entrepreneurship support mechanisms, as well as the influence of entrepreneurship support mechanisms on Entrepreneurial University's results. Thereby, and using the SPSS software, an in depth analysis with respect to these relationships was developed. The results in relation to the

external environment showed that universities with a high supportive institutional context promote more entrepreneurship support mechanisms than the rest and that universities with a high supportive industrial context also promoted more entrepreneurship support mechanisms (except E_CURRI_ACTIVITIES). In contrast, the analyses regarding the internal organisation showed that universities with both an established strategy in entrepreneurship and a supportive management team promoted more entrepreneurship support mechanisms than the rest. Besides, universities with a contemporary organisational design also promoted more entrepreneurship support mechanisms (except E_STAFF).

Afterwards, the relationships between entrepreneurship support mechanisms and Entrepreneurial University's results were analysed. A first analysis corroborated the results obtained through the PLS-SEM approach, since universities that promoted more entrepreneurship support mechanisms obtained better Entrepreneurial University's results. From this baseline, the analysis was duplicated on Hard AEA and Soft AEA. On the one hand, the first test showed that universities that obtained better results on Hard AEA, promoted in a higher level all entrepreneurship support mechanisms (except IND_CURRI). On the other hand, universities that obtained better results on Soft AEA, promoted all entrepreneurship support mechanisms (except E_STAFF) in a higher level. These results showed the importance of both factors, the industry presence in curriculum development and delivery for Soft AEA and staff development in entrepreneurship for Hard AEA.

Furthermore, the impact of engaging with an incubator and a technology park were also measured, since both elements had a huge presence on Entrepreneurial University's literature. Indeed, universities that possess an incubator obtained better results on IND_MOBILITY, CONSULTING, PATENT_LICENSE, ASO and SSO and the ones that had an affiliated technology park obtained better results on PATENT_LICENSE and SSO.

Once the most significant factors for Entrepreneurial University's results development were identified, diverse predictive models were developed in order to identify the core entrepreneurship support mechanisms to improve on Hard AEA and Soft AEA. First of all, the discriminant analysis was applied for this task. As a result, it showed that regarding Hard AEA, universities should promote more E_CURRI_ACTIVITIES and INTERNATIONALISATION in order to obtain better results on Hard AEA. In contrast, so as to improve on Soft AEA, universities should promote more INDUS_CURRI and POLICIES. Afterwards, a multiple regression analysis was developed in order to contrast the previous results. In fact, this latter procedure showed the same results, identifying E_CURRI_ACTIVITIES and INTERNATIONALISATION as the key factors for developing Hard AEA and INDUS_CURRI and POLICIES for developing Soft AEA.

Finally, a universities' taxonomy was developed using the cluster analysis and the successive *t*-test. From these analyses, universities were classified into three statistically different groups regarding the level of Entrepreneurial University's results. Indeed, the test showed that Cluster 2 obtained the worst values on all Entrepreneurial University's results, except for PR_RESEARCH; variable that was in

the same level of Cluster 3. Regarding Cluster 1, these were the universities that obtain the highest values on Soft AEA and were in the same level of Cluster 3 regarding Hard AEA. Finally, Cluster 3 was on the mean on all Entrepreneurial University's results.

6.2   DISCUSSION

The present section collects the discussion regarding the results obtained through the data analysis, contrasting them with the literature review and therefore, understanding how the results are in line or not with previous research results. In order to carry out this discussion, the three specific objectives were taken as the main axis.

6.2.1   The Entrepreneurial University's model

The Entrepreneurial University model was tested using the PLS-SEM approach (see Section 5.3). Concerning this data analysis method, although it was widely adopted in business research fields, such as information systems, consumer behaviour and marketing (Peng and Lai, 2012), there are still few studies regarding Entrepreneurial Universities. Despite this fact, PLS-SEM is seen as a rigorous method which enables the simultaneous testing of the structural component and measurement component in one model, and in addition to which, it can accommodate small sample sizes (Nijssen and Douglas, 2008). Due to this fact and corroborated by the research results, the utility of PLS-SEM on Entrepreneurial Universities' research was established.

Regarding the analysis, the baseline model was tested measuring the simultaneous impacts of external environment factors, internal organisation factors and entrepreneurship support mechanisms on Entrepreneurial University's results. From this analysis, an only significant relationship was detected, the one between entrepreneurship support mechanisms and Entrepreneurial University's results. This means that the other two remaining relationships were not supported; specifically the relationship between external environmental factors and Entrepreneurial University's results, and internal organisational factors and Entrepreneurial University's results. Therefore, entrepreneurship support mechanisms are the core factors for Entrepreneurial University's results achievement.

This result reinforced the importance of entrepreneurship support mechanisms within the Entrepreneurial University, as Guerrero et al. (2011) showed. Indeed, the external environment and the internal organisational factors do not have significant influence on Entrepreneurial University's results; fact that is opposite to some researchers' findings, such as Fini et al. (2011), who proved the direct importance of the external environment in fostering spin-off firm formation. In fact, this analysis showed that there are stronger links between the entrepreneurship support mechanisms and the Entrepreneurial University's results than between the external environment and the organisational internal

factors and the Entrepreneurial University's results; however, analysing each relationship individually it seems that results could be distorted due to the diverse nationalities of the sample universities. Indeed, the analysis between Spanish and the rest of European universities separately (see Section 5.2.1.) shows that the universities with a more supportive environment (in this case the rest of European Universities) obtain better Entrepreneurial University's results. Furthermore, the same thing happens with internal organisational factors; since the universities which have a more supportive internal organisation (the rest of European universities again) obtain better Entrepreneurial University's results.

Continuing with this pattern, various researchers, e.g. Clark (1998), Bratianu and Stanciu (2010), Toledano and Urbano (2008) and Gibb (2012), showed the influence of the external environment on university's internal organisation; since universities needed to adapt to a dynamic external environment and to adopt structures according to it. This assumption was ratified thanks to a second Entrepreneurial University model (see Section 5.3.2), seeing that positive and significant relationships were found between the external environment and the internal organisation. Besides, through this second model the relationship between external environment and the entrepreneurship support mechanisms, and the internal organisation and the entrepreneurship support mechanisms were analysed; establishing positive and significant relationships between them. This analysis shows that the universities which provide its members with a fertile internal environment increase its Entrepreneurial University's results.

Thus, both the external environment and the internal organisation influence Entrepreneurial University's results in an indirect way; through entrepreneurship support mechanisms.

Taking into account the previous results, concretely the relationship between external environmental and internal organisational factors and entrepreneurship support mechanisms, and the discrepancies regarding the literature review; it was necessary to analyse deeper these linkages. Therefore, the effect of both the institutional and industrial context and the effect of strategy, organisational design and management support on entrepreneurship support mechanisms were analysed (see Section 5.3.2.1 and Section 5.3.2.2).

- Regarding the external environment, many scholars recognised that the Entrepreneurial University is influenced by external factors (Etzkowitz, 2003c), most notably institutional laws and policies; like the Bayh-Dole Act in the United States (Mowery and Sampat, 2001, Friedman and Silberman, 2003, Jacob et al., 2003). In this line, it could be said that universities which had a higher institutional support, promote in a higher level all entrepreneurship support mechanisms; confirming the importance of governments' involvement within the entrepreneurship promotion showed by Etzkowitz (2003b), Leydesdorff and Meyer (2003), Etzkowitz (2004), Zhou (2008), Hu (2009), among others.

- Furthermore, the influence of the industrial context was also ratified; since universities which had a higher industrial support promote in a higher

level, seven out of the eight, entrepreneurship support mechanisms. In fact, the only entrepreneurship support mechanism that universities with a high industrial support do not promote is E_CURRI_ACTIVITIES. This is not a surprising result, since university's surrounding industry is interested on promoting "soft" or "indirect" Entrepreneurship University's results (Kim, 2008) and E_CURRI_ACTIVITIES are completely aligned with spin-off firm formation. Thus, it could be stated that universities which had a higher industrial support, promote in a higher level almost all entrepreneurship support mechanisms (except E_CURRI_ACTIVITIES).

- As it was shown through the literature review, an aligned mission & strategy towards entrepreneurship promotion is essential for all experts on Entrepreneurial Universities (see Chapter 2). In this context, transforming a university to be more entrepreneurial requires not only changes in organisational infrastructure but also the adaptation of the university's culture and mission itself (Jacob et al., 2003, Rothaermel et al., 2007). According to this fact, it could be said that universities which had an established entrepreneurial mission and strategy promote more entrepreneurship support mechanisms than the rest.

- Regarding the organisational design, few pioneering studies (e.g. Etzkowitz (2003c) and Etzkowitz and Klofsten (2005)) moved further in their attempt to reveal what resides inside the university's black box, and identify university organisational designs as a key construct of interest. In this vein, the research showed that universities which had a contemporary organisational design promote more almost all entrepreneurship support mechanisms, except E_STAFF. This fact could happen due to the importance of a formal commitment by the leadership team to support and resource staff development in entrepreneurship (European Commission, 2011). Thereby, although the organisation design is seemed to constrain the entrepreneurial behaviour or facilitate it (Gibb and Hannon, 2005), it could be stated that the organisational design do not influence the staff development on entrepreneurship.

- The university management team plays a very important role in universities' entrepreneurial transformation (Zaharia and Gibert, 2005)., since it is identified as a fundamental factor for an Entrepreneurial University (Todorovic et al., 2005, Gibb, 2012). The present research corroborates this fact, identifying a significant positive relationship between the committed management team and the entrepreneurship support mechanisms. Thus, a committed management team towards entrepreneurship promotes in a higher level all entrepreneurship support mechanisms.

Keeping all these results into account, it could be said that both external environmental and internal organisational factors influenced in a positive and significant way the entrepreneurship support mechanisms; promoting Entrepreneurial University's results in an indirect way.

6.2.2   The effect of entrepreneurship support mechanisms

As indicated in the previous sections, entrepreneurship support mechanisms are the factors which have a higher influence on Entrepreneurial University's results. Bearing this in mind, diverse statistical techniques were applied in order to identify the core ones.

First of all, the impact of entrepreneurship support mechanisms on Entrepreneurial University's results, on both Soft AEA and Hard AEA, was consecutively measured. In order to analyse these linkages, the same statistical procedure was performed three times: a *k*-means cluster analysis based on all Entrepreneurial University's results, on Soft AEA and on Hard AEA successively, and the posterior Student's *t*-tests.

- The first analysis, based on all Entrepreneurial University's results, showed that universities which obtained better Entrepreneurial University's results, promote in a higher level all entrepreneurship support mechanisms. This was a quite intuitive fact, since the Entrepreneurial University's model showed a significant and positive relationship between these two factors.

- Afterwards, the second analysis showed that universities which obtained the best results on Hard AEA, promote in a higher level all entrepreneurship support mechanisms except INDUS_CURRI. This result is supported by the fact that these universities do not have a close relationship with industry, since it obtained low values on the Entrepreneurial University's results that are related to industry, specifically: I_TRAINING, IND_MOBILITY, CONSULTING and PR_RESEARCH. Therefore, INDUS_CURRI is a key element for promoting Soft Entrepreneurial University's results, namely the results related to university business cooperation.

- Finally, the third analysis showed that universities with the best results on Soft AEA, promoted in a higher level all entrepreneurship support mechanisms except E_STAFF. In addition, it has to be taken into account that universities that obtain the highest results on Soft AEA also obtain the highest results on Hard AEA; therefore in order to obtain good Entrepreneurial University's results (in general) is not necessary to promote E_STAFF.

These results showed that in general, universities that promoted more entrepreneurship support mechanisms obtained better Entrepreneurial University's results. However, analysing more in deep both types of Entrepreneurial University's results (Hard AEA and Soft AEA), it is seen that universities that sought the promotion of Hard AEA did not have a close relationship with industry, since they had low values on INDUS_CURRI; and in contrast, universities that sought the promotion of Soft AEA and also obtain good results on Hard AEA, did not train their staff on entrepreneurship as they obtained low values on E_STAFF.

Therefore, as many authors stated (e.g. Armbruster (2008), Guerrero and Urbano (2012), Moroz (2012),Berács (2014) and Bronstein and Reihlen (2014)) there is

not a unique typology of Entrepreneurial University; each of them has different characteristics and seeks different objectives. For example, Tijssen (2006) identified three phases for university's transformation into an Entrepreneurial University; in the first phase, the university becomes more aware of the potential for commercialisation, the second phase is characterised by identifying opportunities for commercialisation, and the third phase by developing commercialisation opportunities. Hence, these two factors, INDUS_CURRI and E_STAFF, are the core factors for moving from one phase to the other. In order to accept or reject this relationship, an Entrepreneurial University's taxonomy was developed (see Section 5.5); it will be discussed in the next section (see Section 6.2.3).

Following in this line, analysing the effect of entrepreneurship support mechanisms on Entrepreneurial university's results, the estimation of a predictive model was developed. In fact, this model identified the most critical factors which must be influenced in order to evolve a university from its current scenario (regarding Entrepreneurial University's results, both Hard AEA and Soft AEA) to a superior one. Therefore, two predictive models were developed, one peer each type of Entrepreneurial University's results. Additionally, two different statistical methods were used: the discriminant function analysis and the multiple linear regression. Although the regression has been one of the most used methods for empirical studies in recent years (Becheikh et al., 2006), in this case the discriminant analysis was also applied. Therefore, the results obtained from both procedures were compared and Freel (2005)'s affirmation was corroborated; showing that methods give a similar result.

- With respect to Hard AEA, the variables that showed a greater predictive or discriminant power coincided with the variables included in the regression model; specifically, E_CURRI_ACTIVITIES and INTERNATIONALISATION. In fact, these variables contributed to the first discriminant function (according to their standardised coefficients), which in turn had the higher discriminatory power (91,1%) between both discriminant functions. Furthermore, regarding the prediction ability of both techniques, the model obtained through both discriminant functions provides substantially greater power than the power achieved through the regression classification. The first technique classified correctly the 71% of the cases, which decreased to 52,2% if a cross validation was applied, and the second technique the 40,3% (adjusted R^2=0,403). Besides, it should be taken into account that the predictive capability of the discriminant analysis could vary depending on the category that the university belong (high, medium or low Hard AEA results); namely the 71,4% for high, the 65,2% for medium and 87,5% for low. In cross validation these values changed to 42,9% for high, 47,8% for medium and 68,8% for low.

  Thus, although both procedures reported the same results, the predictive power of the two models was not equal; being the model provided by the discriminant analysis more reliable in terms of future cases classification.

- Regarding Soft AEA, the variables that showed a greater predictive or

discriminant power coincided with the variables included in the regression model; specifically, INDUS_CURRI and POLICIES. In fact, these variables contributed to the first discriminant function (according to their standardised coefficients), which in turn had the higher discriminatory power (71,3%) between both discriminant functions. Furthermore, regarding the prediction ability of both techniques, the model obtained through the two discriminant functions provided substantially greater power than the power achieved through regression classification. The first technique classified correctly the 73,9% of the cases, which decreased to 60,9% if a cross validation was applied, and the second technique the 51,8% (adjusted R^2=0,518). Besides, it should be taken into account that the predictive capability of the discriminant analysis could vary depending on the category that the university belong (high, medium or low Soft AEA results); namely the 69,2% for high, the 72,3% for medium and 88,9% for low. In cross validation these values changed to 61,5% for high, 61,7% for medium and 55,6% for low.

Thus, although both procedures reported the same results, the predictive power of the two models was not equal; being the model provided by the discriminant analysis more reliable in terms of future cases classification.

Matching the results obtained so far, an Entrepreneurial University should work on specific factors depending on its objective: (i) to improve on Hard Entrepreneurial University's results or (ii) to improve on Soft Entrepreneurial University's results. If the university wants to improve on Hard Entrepreneurial University's results it should promote E_CURRI_ACTIVITIES and INTERNATIONALISATION, and do not care about INDUS_CURRI. On the contrary, if university's objective is to increase Soft Entrepreneurial University's results, it should work on INDUS_CURRI and POLICIES, and do not care about E_STAFF.

In addition to the entrepreneurship support mechanisms two more important variables were identified within the literature, the INCUBATOR and the TECH_PARK, which were established as core components for promoting Entrepreneurial University's results.

- The incubator, as many authors stated (e.g. Mian (1996), Meliala (2004) and Palumbo and Dominici (2013)), is a tool employed by some Entrepreneurial Universities as a strategy to provide support structures for teachers and students to initiate new ventures: intellectual, commercial and conjoint (Etzkowitz, 2003c). According to this statement, results showed that universities that possessed an own or affiliated incubator obtained better results on IND_MOBILITY, CONSULTING, PATENT_LICENSE, ASO and SSO; indeed, this universities obtained better results on all Hard AEA, since the main objective of an incubator is to link talent, technology, capital and know-how in order to accelerate the development of spin-off firms and speed the commercialisation of technology (Smilor and Gill, 1986). With respect to the influence of the incubator on IND_MOBILITY and CONSULTING, it could be due to the links between the university and the incubator also creates opportunities for knowledge exchange (OECD, 2014).

- Regarding the technology park, as it was shown in the literature review section, there are two opposite currents. On the one hand, some authors (e.g. Storey and Tether (1998), Lindelöf and Löfsten (2003) and Siegel and Phan (2005)) stated the importance of technology parks to add value by promoting university technology transfer, attract firms with leading edge technology and foster networks and linkages; and on the other hand, other group of authors (e.g. Siegel et al. (2003) and Ferguson and Olofsson (2004)) indicated that companies on parks are not heavily involved with the university. In this line, the results showed that universities that possessed an own or affiliated technology park obtained better results on PATENT_LICENSE and SSO; both Hard AEA. In fact, the results supported the technology parks as universities direct technology transfer promoters (through patents, licenses and spin-off firm formation) and did not foster the networks and linkages between the university and the companies located there, since Soft AEA did not have any differences.

Therefore, both the incubator and the technology park had a specific role inside the Entrepreneurial University, to promote Hard Entrepreneurial University's results.

6.2.3   An Entrepreneurial University's taxonomy

In order to develop a universities' taxonomy depending on Entrepreneurial University's results, the combination of two statistical techniques for clustering (specifically, the hierarchical and the non-hierarchical processes) was used. The sixty-nine universities were clustered, regarding Entrepreneurial University's results, into three different groups: Cluster 1 composed by fourteen universities, Cluster 2 composed by ten universities and Cluster 3 composed by forty-five universities. Afterwards, an ANOVA analysis was developed in order to confirm the difference between the three clusters regarding the Entrepreneurial University's results and entrepreneurship support mechanisms. In the following lines there are further details regarding the three clusters.

- Universities from **Cluster 1** (composed by fourteen universities) are the ones which obtained the best Entrepreneurial University's results; indeed, these universities stand out for their exceptional results on I_TRAINING, CONSULTING and PR_RESEARCH. These three results suggest a higher university business collaboration, since the three are directly related to knowledge transfer between the two organisations. This fact could be due to the high support they have from industry (i.e. high values on INDUS_CONTEXT). Besides, regarding internal organisational factors, the universities from this first cluster also obtain high values as to their organisational design, since they have a contemporary organisational design which promotes the decentralisation of decision making and empowered their employees to innovate (through a bottom-up flow). This fact could also reinforce the promotion of I_TRAINING, CONSULTING and PR_RESEARCH, seeing that the decentralisation of decision making push academic and researcher into knowledge transfer activities. Continuing

with the Entrepreneurial University's results, although universities from this cluster also obtained good results in INFO_DISSEMINATION, NETWORKING and IND_MOBILITY, they are not too far from Cluster 3. Furthermore, regarding PATENT_LICENSES, SSO and ASO (or Hard Entrepreneurial University's results), these universities are in the same level as Cluster 3. Moving on to the entrepreneurship support mechanisms, these universities obtained high values on almost all entrepreneurship support mechanisms except on E_CURRI_ACTIVITIES and E_STAFF. This fact reiterates previous results, ratifying that the support of E_CURRI_ACTIVITIES and E_STAFF is unnecessary for improving on Soft Entrepreneurial University's results if there is a supportive industrial context (INDUS_CONTEXT).

- University from **Cluster 2** (composed by ten universities) are the ones that obtained the worst values on all Entrepreneurial University's results, except for PR_RESEARCH, result that was in the same level of Cluster 3. Furthermore, these universities have neither a supportive external environment nor a supportive internal organisation; since all the values obtained within these factors are really low. These facts could be because these universities are still at the beginning of the Entrepreneurial Universities' path, without promoting entrepreneurship support mechanisms; in addition to a low supportive environment.

- University from **Cluster 3** (composed by forty-five universities) are the ones that obtain average scores on almost all Entrepreneurial University's results, except on PATENT_LICENSES, SSO and ASO; which are on the same level as Cluster 1. Thus, universities from this cluster are good on Hard Entrepreneurial University's results development. Furthermore, it should be highlighted that this group of universities obtained the worst values on PR_RESEARCH; fact that could be related to the high level of Hard AEA, since fostering direct mechanisms of knowledge transfer could reduce PR_RESEARCH. Besides, another reason for the low values on PR_RESEARCH could be the low INDUS_CONTEXT that this group of universities have. In this vein, another characteristic of these universities is the low presence on INDUS_CURRI, which could be also due to the low INDUS_CONTEXT. Regarding these entrepreneurial support mechanisms, E_CURRI_ACTIVITIES and E_STAFF stand out because of their high values; which could be directly related with the good values on Hard AEA.

From this taxonomy, it is clearly showed that these universities are in different stages within the path of the Entrepreneurial University. There is a first stage (Cluster 2) where universities are not inside a supportive external environment and internally they are still backward regarding the organisation and the entrepreneurship support mechanisms. Therefore, they are not obtaining high Entrepreneurial University's results yet. In the second stage (Cluster 3), universities start promoting entrepreneurship (through E_CURRI_ACTIVITIES and E_STAFF) within its collective and although they do not have a really supportive INDUS_CONTEXT, they are obtaining good results in Hard AEA. And finally, the third stage (Cluster 1) is composed by the most Entrepreneurial Universities,

which thanks to a supportive INDUS_CONTEXT obtain really good values on Soft AEA; maintaining the same level as the second stage on Hard AEA. Besides, this cluster promotes less E_CURRI_ACTIVITIES and E_STAFF and obtains the same results on Hard AEA as Cluster 2, reinforcing the importance that a supportive industrial context has.

6.3   CONCLUSIONS

The Entrepreneurial University is made up of three core factors, the external environment and the internal organisation factors, and the entrepreneurship support mechanisms which promoted the Entrepreneurial University's results. However, not all the factors have the same influence level on the different Entrepreneurial University's results.

In this vein, although these Entrepreneurial University's results are composed by nine academic entrepreneurship activities, the division of these activities into two groups (Hard AEA and Soft AEA) was empirically tested. Indeed, these groups were set up due to their impact on the economic and social development: on the one hand, Hard AEA are the results that impact directly on the economic and social development (related to new firm formation); and on the other hand, Soft AEA which are the results that impact indirectly on the economic and social development (related to UBC).

With respect to the entrepreneurship support mechanisms, research results confirmed that they are the core factors for Entrepreneurial University's results achievement. Indeed, the remaining two factors (the external environment and the internal organisation) do not have a direct influence on Entrepreneurial University's results; although they influenced in a positive and significant way the entrepreneurship support mechanisms, promoting Entrepreneurial University's results in an indirect way. Therefore, both a supportive external and internal context are important for an Entrepreneurial University, in order to increase its entrepreneurship support mechanisms level.

In fact, boosting a more supportive external environment is not easy, since it is out of university's competence. Nevertheless, supportive industrial and institutional contexts provide various advantages to the Entrepreneurial University, such as:

- The availability of companies operating in the same sectors as the university that promotes the natural exchange of ideas through formal and informal networks.
- The closer interaction between companies that helps to create a social environment, supporting and encouraging individuals to share knowledge and ideas.
- The university entrepreneurship policies establishment by governments.
- Governments' intervention providing financial incentives, for both entrepreneurship education and academic spin-off firm formation.

Therefore, universities have to develop close ties with both industrial and governmental institutions (the Triple Helix concept) in order to push the previous conditions. In this line, there are some key issues that the university should work on, such as:

- To focus university research and development on areas of potential regional endogenous knowledge-based growth.
- To engage actively the university with local civic and cultural events.
- To strength the relationships with former local alumni.
- To engagement with specific clusters of local industry and services.
- To link graduates with local companies, particularly Small and Medium Enterprises (SMEs).

In relation to the promotion of internal organisation factors, there are some core changes that any university should implement in order to go ahead within the Entrepreneurial University's path, such as:

- To embrace the word "enterprise" or "entrepreneurship" in university's mission and strategies.
- To support entrepreneurship from the top management team, influencing university strategy through the impact on group decision making processes.
- To increase the levels of decentralisation of decision making and the responsibility for strategies as well as operations.
- To empower individuals boosting a bottom-up approach.

Going further into the entrepreneurship support mechanisms' influence, results show clearly that universities that boost more entrepreneurship support mechanisms are the ones that obtain better Entrepreneurial University's results; corroborating the results obtained from the previous model testing. However, there are significant differences between universities that seek the promotion of Hard AEA or Soft AEA. Indeed, universities that seek the promotion of Hard AEA do not have a close relationship with industry, since they do not have industry people inside their curriculum development and delivery process. On the contrary, universities that seek the promotion of Soft AEA and also obtain good results on Hard AEA, do not train their staff on entrepreneurship. Therefore, universities which want to improve their Soft AEA is essential to strengthen their relationship with the business world; and for universities which want to improve their Hard AEA is essential to invest more in training their staff on entrepreneurship.

In addition to entrepreneurship support mechanisms, there are two core entrepreneurship support infrastructures which promote Hard academic entrepreneurship activities: the incubator and the technology park. Results show that universities that are engaged with an incubator and/or a technology park promote more Hard AEA than the rest; highlighting the importance of both elements within the Entrepreneurial University. Thus, if a university wants to increase its Hard AEA it is recommendable to engage with an incubator or/and a technology park. In fact, an incubator provides support for the spin-offs firm formation and to aid academics in the commercialisation of their research. Besides,

the existence of a formal function such as an incubator inside the university indicates importance to this activity. Regarding the technology park, this type of infrastructures facilitates the technology transfer; fostering the creation of spin-off firms based on university-owned (or licensed) technologies.

Furthermore, as the cluster analysis showed, not all universities are in the same level regarding Entrepreneurial University's results. The analysis clearly showed that universities are in different stages within the Entrepreneurial University path; indeed, they could be classified into three stages:

- First stage: Universities from this stage are not inside a supportive external environment and internally are still backward regarding the organisation and the entrepreneurship support mechanisms. Therefore, they are not obtaining high Entrepreneurial University's results.

- Second stage: These universities start promoting entrepreneurship and obtaining good results on Hard AEA through two main activities: on the one hand, providing support within the whole entrepreneurship process and on the other hand, training its staff on entrepreneurship. Besides, these universities do not have a really supportive industrial context.

- Third stage: Universities from this stage, thanks to a supportive industrial context obtain really good values on Soft AEA; maintaining the same level as the second stage on Hard AEA. Moreover, these universities promote less entrepreneurship support mechanisms, concretely the support within the whole entrepreneurship process and the training in entrepreneurship for its staff. In fact, the core factor for staying in this stage is to have a supportive industrial context.

Continuing in this vein, universities are not motionless within a specific stage; they can improve and move from one stage to the upper one. In fact, an Entrepreneurial University has to work on specific factors depending on its objective. If the university wants to improve on Hard AEA it has to provide support within the whole entrepreneurship process and promote its internationalisation activity, and do not care about industries' presence on curriculum development and delivery. Therefore, with respect to the promotion of these two entrepreneurship support mechanisms, universities should implement the following activities:

- Regarding university's support within the whole entrepreneurship process, academic entrepreneurship is not a single event, it is a multi-stage process model that identifies the key actors, activities, potential stakeholders and key success drivers associated with each stage of the innovation commercialisation process (Salamzadeh et al., 2011, Wood, 2011). Therefore, the university should provide supportive activities within each phase of the entrepreneurship process; such as: talks with entrepreneurs in order to make aware of the entrepreneurship importance, innovation and creativity workshops in order to generate new possible business ideas, business model and business plan courses in order to become this business ideas into business project and finally, courses on new business venture launching.

- Internationalisation is a key tool for an Entrepreneurial University, since mobility (beyond the local level to the international plane) of students, academics and industrial collaborators in developing and enhancing Entrepreneurial Universities is essential (Allinson et al., 2012, Gibb, 2012). Therefore universities have to increase their international activities and collaborations.

On the contrary, if university's objective is to increase Soft AEA, it has to work on promoting industries' presence on curriculum development and delivery and developing policies and laws regarding entrepreneurial issues. Besides, they do not have to make any effort on training its staff in entrepreneurship. In this vein, so as to boost these two entrepreneurship support mechanisms universities should work on the following activities:

- The industry presence in curriculum D&D is the process of creating a learning environment and the development of human resources relevant to modern society. In fact, universities have to include the following mechanisms: university business collaboration in the development of a fixed programme of courses, modules, planned experiences as well as guest lectures by delegates from private and public organisations within undergraduate, graduate, PhD programmes or through further professional education (Davey et al., 2011).

- Regarding policies on both UBC (between universities and enterprises) and entrepreneurship (between the university and the researcher/ worker/ student), universities should develop some policies in order to establish a working framework. On the one hand, regarding UBC policies, universities should clarify students' internships, knowledge transfer activities and the promotion of R&D, among other activities. And on the other hand, regarding entrepreneurship universities should establish the distribution of royalty rates between inventors and the university, since it could influence the propensity of entrepreneurs to found firms to exploit university inventions, the university's choice to take an equity stake in the spin-off firm in exchange for paying patenting, marketing, or other up-front costs and the use of internal venture capital funds has to be regulated.

Summing up, Entrepreneurial Universities can be located within different stages regarding their Entrepreneurial University's results and they can move from one stage to other promoting some specific entrepreneurship support activities.

Further on there are detailed the research contribution represented by these results, as well as the research limitations of the study and possible future research lines.

6.4 RESEARCH CONTRIBUTIONS

The contribution of this thesis was given by the fulfilment of the objectives, as well as by the achievement of the research challenges. Therefore, the present section collects these contributions.

As it was shown through the literature review, there is no consensus within the literature on Entrepreneurial Universities. In fact, there are several Entrepreneurial University's definitions, characteristics and models; however each of them adds new concepts or adjectives, instead of unifying them. Due to this fact, it was necessary to identify the factors that made up an Entrepreneurial University, including the measurement criteria and the relationships between both. Thus, the following contributions were done:

- Clarification of the Entrepreneurial University concept, identifying the main factors that made it up and the indicators for measuring its results. In fact, fifteen factors were identified as the most determining factors and nine specific academic entrepreneurship activities as the Entrepreneurial University's results.

- An empirically tested Entrepreneurship University model based on external environmental factors, internal organisational factors, entrepreneurship support mechanisms and Entrepreneurial University's results.

- A validated self-devised questionnaire, based on referent authors, for measuring the Entrepreneurial University.

Regarding the predictive model on Entrepreneurial Universities, which sought to identify the most critical factors that influence a university within the Entrepreneurial University path, it is worth highlighting the double approach followed: the discriminant function analysis and the multiple linear regression. From these analyses various contributions were drawn up:

- Both the discriminant analysis and the linear regression can be used for developing a predictive model obtaining the same results, although the first analysis had a greater reliability in terms of predictive power than the latter. Indeed, the discriminant model classified correctly the 71% of Hard AEA and the 73,9% of Soft AEA; compared with a 40,3% of Hard AEA and 51,8% of Soft AEA of the model estimated by the multiple regression.

- A criterion for classifying universities according to their development of Hard AEA and Soft AEA, validated through the discriminant analysis; which was established with a classification appropriateness of 52,2% and 60,9% consecutively.

Finally, moving on to the contributions regarding the research methodology, it is worth mentioning that an institutional level approach was followed; developing a quantitative analysis of the entire university. Moreover, a variance-based SEM approach, specifically the PLS-SEM approach, was used to analyse the model; a

novel method in Entrepreneurial University's research. Thus, the following contributions were done:

- An empirical-institutional analysis on Entrepreneurial Universities, using the university as the unit of analysis.

- The adequacy of the use of PLS-SEM technique in Entrepreneurial University's research, offering an excellent capability for work with small samples.

6.5   RESEARCH LIMITATIONS

As with any research, several limitations should be taken into account in the analysis and interpretation of results. Thereby, this section collects the limitations of the present thesis.

The main limitation of this research was the sample size used, which did not allow a more rigorous statistical analysis. Indeed, sixty-nine European universities answered the whole questionnaire out of the 361 surveys mailed. Likewise, the results' generalisability is completely unreal; since, although normality was achieved for all variables, the sample was not significant enough to extrapolate the results to the whole population. This makes that the findings of the previous section were applicable only to the sample tested.

Accordingly, another limitation dealt with the measures used in the research; since data was gathered throughout scales getting TTO directors' self-perceptions on her/his university, and therefore these variables have a degree of subjectivity.

Another limitation was the geographical location of universities, since almost half of them were from Spain (due to the proximity) and within the remaining half the distribution between European sub-regions was not equitable. In fact, only the 2,89% of universities were from Easter Europe, 24,64% from Northern Europe, the 11,59% from Western Europe and finally, the highest volume is the 60,87% from Sothern Europe.

Regarding the two developed predictive models (using the discriminant analysis and linear regression) to identify the most critical entrepreneurship support mechanisms, it should be highlighted that the dependent variables used in the estimation were only two (Hard AEA and Soft AEA). This fact could be a limitation, since only a general overview of Hard AEA and Soft AEA was shown; without considering the nine Entrepreneurial University's results established within the Entrepreneurial University model.

Finally, highlight that although these difficulties limit the scope of the research, these limitations also open the possibility of extending the study; through future research lines.

6.6   FUTURE RESEARCH LINES

From the research done, several issues could be worked on deeper and were identified as interesting for raise future research. Therefore, the present section collects the main points to be developed in future research.

During the literature review it was found that in recent years the Entrepreneurial University domain has received increased attention from scholars, although little was known about the factors that contribute to the emergence of these Entrepreneurial Universities. Due to this fact, future research should continue identifying and measuring the influence of this factors in order to develop a more completed model of the Entrepreneurial University.

Furthermore, the research should be opened to more European universities, in order to increase the size and the homogeneity of the sample; and then, analyse the real differences between universities from different countries; since there are specific cultural, political... determinants that may affect the results. In this vein, and in order to get a global vision of the Entrepreneurial University, it could be interesting to survey different people within the university. Indeed, they could be classified into two groups: on the one hand, the management team, the TTO director, etc. and on the other hand, the researchers, professors, etc. This large number of questionnaires could allow developing more complex models that include latent (unobserved) variables, formative variables, chains of effects (mediation), and multiple group comparisons (e.g. multilevel analysis)of these more complex relationships.

In addition, based on the limitations explained in the previous section, the Entrepreneurial University factors used within the predictive models should be expanded to all Entrepreneurial University's results; in order to identify specific entrepreneurship support mechanisms for each Entrepreneurial University's results.

In this vein, it could be interesting to test the Entrepreneurial University model taking into account the three intrinsic characteristics, geographical location, ownership status and the engineering faculty, since the model could be different for each of the cases.

Regarding the Entrepreneurial University's taxonomy, future research could develop an Entrepreneurial Road Map in order to help universities on their path towards an upper level; since the most influential factors were already identified. Thereby, a longitudinal study could be developed based on an action research where the Entrepreneurial Road Map could be implemented.

Finally, highlight that the university is not the only institution that could the entrepreneurial; indeed, the vocational education and training centres could be another institution interested on duplicating the present research.

Chapter 7
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Chapter 8
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Annexes

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8. ANNEXES

8.1 Annexe A: Origin of questionnaire items

INDEPENDENT VARIABLES			
CONSTRUCT	**ITEMS**	**SCALE TYPE**	**SOURCE**
Institutional Context	Degree to which **institutional context** is supportive for entrepreneurial activities.	Type Likert (5 point)	Fini et al. (2009)
Industrial Context	Degree to which **nearest business sectors** are appropriate for commercial exploitation	Type Likert (5 point)	Fini et al. (2009)
Industrial Context	Degree to which **local context** is fertile for NTBF (New Technology Based Firms)	Type Likert (5 point)	Fini et al. (2009)
Institutional Context	Degree to which Government has made **legislative changes** in order to create necessary conditions for entrepreneurship	Type Likert (5 point)	Fini et al. (2009)
Institutional Context	Degree to which Government **encourages universities** to focus directly on technology commercialization and spin-off activity	Type Likert (5 point)	Fini et al. (2009)
Institutional Context	Degree to which Government **provides financial incentives** for entrepreneurship	Type Likert (5 point)	Fini et al. (2009)
Industrial Context	Degree to which your university surrounding industry has **High Technology** level	Type Likert (5 point)	Gilsing et al. (2010)
Industrial Context	Degree to which university surrounding industry works within sectors with **immature technologies** (software, microelectronics, multimedia…)	Type Likert (5 point)	Gilsing et al. (2010)
Industrial Context	Degree to which your university surrounding industry has **high budget** for R&D	Type Likert (5 point)	Gilsing et al. (2010)
Mission &Strategy	Degree to which your university has a **Technology Transfer Strategy**	Type Likert (5 point)	Gómez Gras et al. (2008)
Mission &Strategy	Degree to which **Entrepreneurship** is seen as central in university **strategy**	Type Likert (5 point)	Gibb (2012)
Mission &Strategy	Degree to which **Entrepreneurship Education** is linked to your university Goals	Type Likert (5 point)	Gibb (2012)
Mission &Strategy	Degree to which **University Business Cooperation** is seen as central in university **strategy**	Type Likert (5 point)	Davey et al. (2011)
Management Support	Degree to which your university Dean and executive team **support entrepreneurship**	Type Likert (5 point)	Gibb (2012)
Management Support	Degree to which Entrepreneurship has **presence on your university agenda**	Type Likert (5 point)	Gibb (2012)
Management Support	Degree to which your university **governance structure** is able to adapt to environmental changes	Type Likert (5 point)	Guerrero and Urbano (2010)
Organisational Design	Degree to which your Faculty **organisation design** creates a **connection between** teaching, research and administration functions	Type Likert (5 point)	Guerrero and Urbano (2010)
Organisational Design	Degree to which your university's organisation design facilitates **decentralized decision making**	Type Likert (5 point)	Gibb (2012)
Organisational Design	Degree to which your university Deans and Heads are **proactive** in fund and revenue raising	Type Likert (5 point)	Gibb (2012)
Organisational Design	Degree to which your university revenue raising activity is **delegated** to departments	Type Likert (5 point)	Gibb (2012)
Policies	Degree to which your **university policies and regulations** support **Technology Transfer**	Type Likert (5 point)	Gómez Gras et al. (2008)
Policies	Degree to which your **university policies and regulations** support **NTBF creation**	Type Likert (5 point)	Davey et al. (2011)
Policies	Degree to which your **university policies and regulations** support **University-Business Cooperation**	Type Likert (5 point)	Declaration (2007)

	INDEPENDENT VARIABLES		
CONSTRUCT	**ITEMS**	**SCALE TYPE**	**SOURCE**
Internationalisation	Degree to which your university is **focused** upon **internationalisation**	Type Likert (5 point)	Gibb (2012)
Internationalisation	Degree to which your university has **International** research and development **links**	Type Likert (5 point)	Gibb (2012)
Internationalisation	Degree to which your university has **overseas joint degrees**	Type Likert (5 point)	Gibb (2012)
Internationalisation	Degree to which your university has **high revenue** from International activity	Type Likert (5 point)	Gibb (2012)
Entrepreneurial Process	Degree to which your university has presence on **Opportunity Identification**	Type Likert (5 point)	Plaschka and Welsch (1990)
Entrepreneurial Process	Degree to which your university has presence on **Business Plan development**	Type Likert (5 point)	Plaschka and Welsch (1990)
Entrepreneurial Process	Degree to which your university provides support **along the Patent Process** (disclosure, patent applications, etc.)	Type Likert (5 point)	Plaschka and Welsch (1990)
Entrepreneurial Process	Degree to which your university provides support for **Spin-off initiation**	Type Likert (5 point)	Plaschka and Welsch (1990)
Industry presence on Curriculum D&D	Degree to which your university has **business people** working on its **Curriculum** development and delivery	Type Likert (5 point)	Davey et al. (2011)
Industry presence on Curriculum D&D	Degree to which your University has **business people participating** in University **academic courses**.	Type Likert (5 point)	Davey et al. (2011)
Industry presence on Curriculum D&D	Degree to which your University has **collaborative education programs with firms**.	Type Likert (5 point)	Davey et al. (2011)
Industry presence on Curriculum D&D	Degree to which your University has **Business people participating in its advisory boards** for directing research agendas.	Type Likert (5 point)	Davey et al. (2011)
Industry presence on Curriculum D&D	Degree to which your University involves **Business people in University Governance** (in curriculum development and delivery).	Type Likert (5 point)	Davey et al. (2011)
Funds for Entrepreneurship	Degree to which your university **provides resources** (and seek public and private sector matching) to help fund entrepreneurship teaching and research	Type Likert (5 point)	Gibb (2012)
Funds for Entrepreneurship	Degree to which your university ensures a consistent and **adequate level of funding** for entrepreneurship education programmes	Type Likert (5 point)	Volkmann et al. (2009)
Funds for Entrepreneurship	Degree to which your university provides **economical support** for business creation (seed capital)	Type Likert (5 point)	Kirby et al. (2011)
Entrepreneurship Education	Degree to which your university encourages the development of **research on entrepreneurship** as well as the field of entrepreneurship education	Type Likert (5 point)	Volkmann et al. (2009)
Entrepreneurship Education	Degree to which your university facilitates the provision of **direct training and/or support programmes** for entrepreneurs in the process of starting companies	Type Likert (5 point)	Volkmann et al. (2009)
Entrepreneurship Education	Degree to which your university integrates **Entrepreneurship education** into the **curriculum**	Type Likert (5 point)	Volkmann et al. (2009)
Staff development in Entrepreneurship	Degree to which your university provides **Start up new venture training** for all the **staff**	Type Likert (5 point)	Gibb (2012)
Staff development in Entrepreneurship	Degree to which your university provides the appropriate **training** for all the **staff** in the area of **technology transfer**	Type Likert (5 point)	Volkmann et al. (2009)

INDEPENDENT VARIABLES			
CONSTRUCT	**ITEMS**	**SCALE TYPE**	**SOURCE**
Staff development in Entrepreneurship	Degree to which your university provides the appropriate **training** for all the **staff** in the area of **technology transfer**	Type Likert (5 point)	Volkmann et al. (2009)
Staff development in Entrepreneurship	Degree to which your university provides **Entrepreneurship education training** for all the **staff**	Type Likert (5 point)	Gibb (2012)
Teaching methodologies	Degree to which your university supports the **development of entrepreneurship course materials** (books, cases, online games, videos, etc.)	Type Likert (5 point)	Volkmann et al. (2009)
Teaching methodologies	Degree to which your university promotes the application of **"learning by doing"** through project-based learning, internships and consulting	Type Likert (5 point)	Volkmann et al. (2009)
Teaching methodologies	Degree to which your university supports the **involvement of entrepreneurs and companies** in entrepreneurship courses and activities	Type Likert (5 point)	Volkmann et al. (2009)
Incubator Engagement	Does your university have its own physical **Incubator**?	Dichotomic (0-1)	Nosella and Grimaldi (2009)
Science Park Engagement	Does your university have any affiliated **science/technology park**?	Dichotomic (0-1)	Nosella and Grimaldi (2009)

DEPENDENT VARIABLES			
CONSTRUCT	**ITEMS**	**SCALE TYPE**	**SOURCE**
Information dissemination	Degree to which your University participate in **co-authoring research papers** with Business people.	Type Likert (5 point)	Santoro (2000)
Information dissemination	Degree to which your University has **Thesis projects in cooperation** with firms.	Type Likert (5 point)	Brennenraedts et al. (2006)
Information dissemination	Degree to which your University has **collaboration activities** facilitating academics interaction with business (e.g., collaborative workshops).	Type Likert (5 point)	Davey et al. (2011)
Networking	Degree to which your University researchers have **informal contacts** with Business people (phone, email,…).	Type Likert (5 point)	Jensen et al. (2009)
Networking	Degree to which your University researchers have **formal contacts** with Business people (conferences, exhibitions, workshops,…).	Type Likert (5 point)	Jensen et al. (2009)
Networking	Degree to which your University develops **Networking sessions** or meetings for academics to meet business people.	Type Likert (5 point)	Davey et al. (2011)
Mobility to industry	Degree to which your University cooperates with Business in respect to **Mobility of students**.	Type Likert (5 point)	Davey et al. (2011)
Mobility to industry	Degree to which your University cooperates with Business in respect to **Mobility of academics**.	Type Likert (5 point)	Davey et al. (2011)
Mobility to industry	Degree to which your University has **Industry projects as part of training** and education (e.g., final year project, PBL).	Type Likert (5 point)	Davey et al. (2011)
Mobility to industry	Degree to which your University has **personnel exchanges** with Business	Type Likert (5 point)	Davey et al. (2011)

DEPENDENT VARIABLES			
CONSTRUCT	**ITEMS**	**SCALE TYPE**	**SOURCE**
Consulting	Degree to which your University gets **consulting incomes** from Business sector.	Type Likert (5 point)	D'Este and Perkmann (2011)
Industry Training Courses	Degree to which your University **cooperates with Business in respect to Lifelong Learning** (Industry Training Courses).	Type Likert (5 point)	Davey et al. (2011)
Collaborative Research	Degree to which your University **develops contract research** with Business.	Type Likert (5 point)	Davey et al. (2011)
Collaborative Research	Degree to which your University **raises revenue from industry**.	Type Likert (5 point)	D'Este and Perkmann (2011)
Collaborative Research	Degree to which your University **develops research project** in collaboration with business.	Type Likert (5 point)	Davey et al. (2011)
Patents & Licenses	Degree to which your University askes for **Patent applications**.	Type Likert (5 point)	Jung and Walsh (2010)
Patents & Licenses	Degree to which your University gets **incomes from Licenses**.	Type Likert (5 point)	Jung and Walsh (2010)
Patents & Licenses	Degree to which your University researchers **use Patenting and Licensing as a Technology Transfer mechanism**.	Type Likert (5 point)	Jung and Walsh (2010)
Student Spin-Offs	Degree to which your University **creates Students Spin-Off**.	Type Likert (5 point)	Csapo (2007)
Student Spin-Offs	Degree to which your University **Students combine their studies with the creation of their own business** simultaneously.	Type Likert (5 point)	Csapo (2007)
Student Spin-Offs	Degree to which your University **Students create a spin-off firm on an academic project** (PBL, final year project, etc.).	Type Likert (5 point)	Csapo (2007)
Student Spin-Offs	Degree to which your University **Students are involved within an Entrepreneurial Process**.	Type Likert (5 point)	Csapo (2007)
Academic Spin-Offs	Degree to which your University creates **Academic Spin-Off**.	Type Likert (5 point)	Gómez-Gras et al. (2007)
Academic Spin-Offs	Degree to which your University **researchers combine academic job with the creation of their own business** simultaneously	Type Likert (5 point)	Gómez-Gras et al. (2007)
Academic Spin-Offs	Degree to which your University **researchers create to spin-off a company based on existing or past research projects**	Type Likert (5 point)	Gómez-Gras et al. (2007)
Academic Spin-Offs	Degree to which your University **researchers are involved within an Entrepreneurial Process**	Type Likert (5 point)	Gómez-Gras et al. (2007)

8.2   Annexe B: Presentation letter of the questionnaire

8.2.1   Spanish version

Estimado Sr/Sra.,

Me acerco de nuevo a usted en relación a la investigación que estamos realizando en torno a las **características que conforman una Universidad,** en el marco de la **Universidad Emprendedora**. Término que se refleja, cada vez más, tanto en los marcos de política educativa de los gobiernos (EU 2005), como en la literatura internacional; como elemento clave en el desarrollo económico y social de su entorno.

Esta investigación, forma parte de la Tesis Doctoral que estoy realizando en el Departamento de Mecánica y Producción Industrial de la Facultad de Ingeniería de Mondragon Unibertsitatea; la cual, busca estudiar las **Universidades referentes a nivel Europeo** para así poder caracterizar éstas en relación al concepto Universidad Emprendedora.

Como primer paso para llevar a cabo dicha investigación, se ha elaborado (en base a autores como Gibb (2012) y Klofsten and Jones-Evans (2000), entre otros) un cuestionario (el pdf adjunto en el email) que debe ser cumplimentado por las OTRIs de las Universidades Españolas. Por esta razón, me acerco a usted para pedirle que **cumplimente dicho cuestionario que no le llevará más de 20 minutos.**

Además, cara a facilitarle dicha tarea, podríamos establecer una entrevista, en la cual podríamos repasar el cuestionario paso a paso y aclarar las dudas. En ausencia de respuesta, me pondré en contacto telefónico con usted a partir de la semana que viene.

Finalmente, agradecerle de antemano su valioso tiempo y cooperación al rellenar este cuestionario.

Atentamente,

Leire Markuerkiaga.

PD: Si ya ha completado y enviado el cuestionario, por favor, acepte mi más sincero gracimineto y disculpe las molestias.

8.2.2   English version

Dear Sir or Madam,

I am writing to you concerning the research we are currently conducting on the **characteristics of an Entrepreneurial University** in Europe. Term which is reflected more and more within both governments' educational policy frameworks (EU 2005) and international literature; as a core element for the economic and social development of the environment.

This research work is part of my doctoral thesis, which I am developing at Mondragon University - Faculty of Engineering (Spain), and seeks to study referent European Universities and characterize them in relation to the Entrepreneurial University concept.

Currently, I have gathered data from Spanish Universities and now I would like to go a step further and spread the research among European Universities. Therefore, I would like to ask you to complete and return the attached questionnaire. It should take approximately **20 minutes to complete the questionnaire.**

This information you share will be treated confidentially and will be used only for the purpose of this study.

A summary of the research finding could be e-mailed to you early in 2014. Kindly contact me at this e-mail address: lmarkuerkiaga@mondragon.edu

Thank you for your collaboration,

Leire Markuerkiaga

PS: If you have already completed and returned the questionnaire, please accept my sincere thanks and sorry for the inconvenience.

8.3   Annexe C: Questionnaire used for data collection

Name and Surname: _____	
Country: _____	
Name of University: _____	

Please indicate the ownership status of your institution:	☐ Private	☐ Public

Please indicate in which of the following areas your University has research activity:	☐ Arts & Humanities	☐ Health Sciences
	☐ Social Sciences and Law	☐ Engineering and Architecture
	☐ Science	

Does your University...	Yes	No
have an Incubator?	☐	☐
have a Central support unit for Entrepreneurship or an Entrepreneurship Centre?	☐	☐
have an Entrepreneurial Programme?	☐	☐
have a Business Plan Competition?	☐	☐
offer a undergraduate degree in Entrepreneurship?	☐	☐
offer graduate degree in Entrepreneurship?	☐	☐
offer a PhD degree in Entrepreneurship or an Entrepreneurship Doctoral Programme?	☐	☐
have an Entrepreneurship Research Chairs?	☐	☐
have an affiliated Science/Technology Park?	☐	☐
have a Technology or Engineering Faculty/School?	☐	☐

REGARDING YOUR UNIVERSITY ACADEMIC ENTREPRENEURSHIP ACTIVITIES	Null	Low	Inter.	High	V.High
Degree to which your University...					
creates Academic Spin-Off	☐	☐	☐	☐	☐
creates Students Spin-Off	☐	☐	☐	☐	☐
askes for Patent applications	☐	☐	☐	☐	☐
gets incomes from Licenses	☐	☐	☐	☐	☐
involves Business people in University Governance (in curriculum development and delivery)	☐	☐	☐	☐	☐
researchers have informal contacts with Business people (phone, email, ...)	☐	☐	☐	☐	☐
researchers have formal contacts with Business people (conferences, exhibitions, workshops, ...)	☐	☐	☐	☐	☐
participate in co-authoring research papers with Business people	☐	☐	☐	☐	☐
has Thesis projects in cooperation with firms	☐	☐	☐	☐	☐
has business people participating in University academic courses	☐	☐	☐	☐	☐
has collaborative education programs with firms	☐	☐	☐	☐	☐
cooperates with Business in respect to Lifelong Learning (Industry Training Courses)	☐	☐	☐	☐	☐
has Joint laboratories with firms	☐	☐	☐	☐	☐
cooperates with Business in respect to Mobility of students	☐	☐	☐	☐	☐
cooperates with Business in respect to Mobility of academics	☐	☐	☐	☐	☐
develops contract research with Business	☐	☐	☐	☐	☐
gets consulting incomes from Business sector	☐	☐	☐	☐	☐
develops research projects in collaboration with Business	☐	☐	☐	☐	☐

Your University is below, above or equal to the mean of European Universities on...	below	equal	above
Spin-Off Firm Formation (the mean is 1.9 Spin-offs per year)[1]	☐	☐	☐
Patent Application (the mean is 11.8 Patent applications per year)[1]	☐	☐	☐
Licenses (the mean is 19.2 Licenses per year)[1]	☐	☐	☐

REGARDING YOUR EXTERNAL ENVIRONMENT	Null	Low	Inter.	High	V.High
Degree to which your...					
institutional context is supportive for entrepreneurial activities	☐	☐	☐	☐	☐
nearest business sectors are appropriate for commercial exploitation	☐	☐	☐	☐	☐
local context is fertile for NTBF (New Technology Based Firms)	☐	☐	☐	☐	☐
Degree to which your Government...					
has made legislative changes in order to create necessary conditions for entrepreneurship	☐	☐	☐	☐	☐
encourages universities to focus directly on technology commercialization and spin-off activity	☐	☐	☐	☐	☐
provides financial incentives for entrepreneurship	☐	☐	☐	☐	☐
Degree to which your University surrounding industry...					
has High Technology level	☐	☐	☐	☐	☐
works within sectors with immature technologies (software, microelectronics, multimedia...)	☐	☐	☐	☐	☐
has high budget for R&D	☐	☐	☐	☐	☐

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[1] Data from ProTon Europe Annual Survey Report (http://www.protoneurope.org/)

REGARDING YOUR UNIVERSITY'S MISSION AND STRATEGY

Degree to which…	Null	Low	Inter.	High	V.High
Entrepreneurial activity is considered in your University's mission	☐	☐	☐	☐	☐
Entrepreneurship Education is linked to your University goals	☐	☐	☐	☐	☐
your University has a Technology Transfer Strategy	☐	☐	☐	☐	☐
Entrepreneurship is seen as central in your University strategy	☐	☐	☐	☐	☐
University Business Cooperation is seen as central in your University strategy	☐	☐	☐	☐	☐

REGARDING YOUR UNIVERSITY'S POLICIES & REGULATIONS

Degree to which your University policies and regulations support…	Null	Low	Inter.	High	V.High
Technology Transfer	☐	☐	☐	☐	☐
NTBF creation	☐	☐	☐	☐	☐
University-Business Cooperation	☐	☐	☐	☐	☐
proper incentives, rewards and recognition to encourage entrepreneurship toward its workers	☐	☐	☐	☐	☐

REGARDING YOUR UNIVERSITY'S GOVERNANCE STRUCTURE

Degree to which…	Null	Low	Inter.	High	V.High
the Dean and executive team support entrepreneurship	☐	☐	☐	☐	☐
Entrepreneurship has presence on your University agenda	☐	☐	☐	☐	☐
your University governance structure is able to adapt to environmental changes	☐	☐	☐	☐	☐

REGARDING YOUR UNIVERSITY'S ORGANISATIONAL DESIGN

Degree to which…	Null	Low	Inter.	High	V.High
your University organisation design creates a connection between teaching and research	☐	☐	☐	☐	☐
your University organisation design facilitates and supports bottom-up entrepreneurial and innovative behaviour	☐	☐	☐	☐	☐
your University organization design facilitates decentralized decision making	☐	☐	☐	☐	☐

REGARDING YOUR UNIVERSITY'S WAYS OF LEVERAGING FINANCE

Degree to which your University…	Null	Low	Inter.	High	V.High
Deans and Heads are proactive in fund and revenue raising	☐	☐	☐	☐	☐
revenue raising activity is delegated to departments	☐	☐	☐	☐	☐
raises revenue from non-fee and traditional public sources	☐	☐	☐	☐	☐
raises revenue from EC research programmes	☐	☐	☐	☐	☐
raises revenue from other international programmes	☐	☐	☐	☐	☐
raises revenue from industry	☐	☐	☐	☐	☐

REGARDING YOUR UNIVERSITY'S ENTREPRENEURIAL PROCESS

Degree to which your University provides support…	Null	Low	Inter.	High	V.High
along all of the entrepreneurial growth phases, not just the NTBF creation phase	☐	☐	☐	☐	☐
in Entrepreneurship Awareness	☐	☐	☐	☐	☐
in Identifying Opportunities	☐	☐	☐	☐	☐
in Business Plan Development	☐	☐	☐	☐	☐
along the Patent Process (disclosure, patent applications, etc.)	☐	☐	☐	☐	☐
for Spin-off Initiation	☐	☐	☐	☐	☐

REGARDING INTERNATIONALISATION AT YOUR UNIVERSITY

Degree to which your University…	Null	Low	Inter.	High	V.High
is focused upon internationalisation	☐	☐	☐	☐	☐
has International research and development links	☐	☐	☐	☐	☐
has overseas joint degrees	☐	☐	☐	☐	☐
has high revenue from International activity	☐	☐	☐	☐	☐

REGARDING FINANCIAL FUNDS FOR ENTREPRENEURSHIP

Degree to which your University…	Null	Low	Inter.	High	V.High
provides resources to fund entrepreneurship teaching and research	☐	☐	☐	☐	☐
ensures a consistent and adequate level of funding for entrepreneurship education programmes	☐	☐	☐	☐	☐
provides economical support for business creation (e.g., seed capital)	☐	☐	☐	☐	☐

REGARDING ENTREPRENEURSHIP EDUCATION AT YOUR UNIVERSITY

Degree to which your University…	Null	Low	Inter.	High	V.High
integrates Entrepreneurship education into the curriculum	☐	☐	☐	☐	☐
encourages the development of research on entrepreneurship and entrepreneurship education	☐	☐	☐	☐	☐
facilitates the provision of direct training and/or support programmes for entrepreneurs	☐	☐	☐	☐	☐

REGARDING STAFF DEVELOPMENT IN ENTREPRENEURSHIP AT YOUR UNIVERSITY

Degree to which your University…	Null	Low	Inter.	High	V.High
provides the appropriate training for all the staff in the area of technology transfer	☐	☐	☐	☐	☐
provides "New venture creation" training for all the staff	☐	☐	☐	☐	☐
provides Entrepreneurship education training for all the staff	☐	☐	☐	☐	☐

REGARDING ENTREPRENEURSHIP TEACHING METHODOLOGIES AT YOUR UNIVERSITY

Degree to which your University…	Null	Low	Inter.	High	V.High
supports the development of entrepreneurship course materials (e.g. cases, books, games, videos)	☐	☐	☐	☐	☐
promotes the application of "learning by doing" (e.g., through PBL, internships, consulting)	☐	☐	☐	☐	☐
supports the involvement of entrepreneurs and companies in entrepreneurship courses	☐	☐	☐	☐	☐

REGARDING YOUR UNIVERSITY SPIN-OFF FIRM FORMATION, PATENTS AND LICENSES	Null	Low	Inter.	High	V.High
Degree to which your University researchers...					
combine academic job with the creation of their own business simultaneously	☐	☐	☐	☐	☐
create to spin-off a company based on existing or past research projects	☐	☐	☐	☐	☐
are involved within an Entrepreneurial Process	☐	☐	☐	☐	☐
give up their academic job and become entrepreneurs	☐	☐	☐	☐	☐
Degree to which your University Students...					
combine their studies with the creation of their own business simultaneously	☐	☐	☐	☐	☐
create a spin-off firm on an academic project (PBL, final year project, etc.)	☐	☐	☐	☐	☐
are involved within an Entrepreneurial Process	☐	☐	☐	☐	☐
Degree to which your University...					
commercialise R&D results (Technology transfer)	☐	☐	☐	☐	☐
researchers use Patenting and Licensing as a Technology Transfer mechanism	☐	☐	☐	☐	☐

REGARDING YOUR UNIVERSITY UBC LEVEL OF INTENSITY					
Degree to which your University...					
has Business people participating in its advisory boards for directing research agendas	☐	☐	☐	☐	☐
has business people working on its Curriculum development and delivery	☐	☐	☐	☐	☐
has business people as guest lecturers	☐	☐	☐	☐	☐
has contacts with graduates employed in the business sector	☐	☐	☐	☐	☐
has students participating in Corporate R&D projects	☐	☐	☐	☐	☐
has Industry projects as part of training and education (e.g., final year project, PBL)	☐	☐	☐	☐	☐
covers the training of Business employees	☐	☐	☐	☐	☐
can access to technical facilities or research centres at Business sector	☐	☐	☐	☐	☐
students are hired by the firm as direct result of UBC	☐	☐	☐	☐	☐
recent graduates are hired by firms	☐	☐	☐	☐	☐
has personnel exchanges with Business	☐	☐	☐	☐	☐
has the participation of Business people in University sponsored extension services for new technologies	☐	☐	☐	☐	☐
gets Business grants specifically for advancing new technologies	☐	☐	☐	☐	☐
develops research consortiums	☐	☐	☐	☐	☐
develops Networking sessions or meetings for academics to meet business people	☐	☐	☐	☐	☐
has collaborative activities facilitating students interaction with business (e.g., student projects with business)	☐	☐	☐	☐	☐
has collaboration activities facilitating academics interaction with business (e.g., collaborative workshops)	☐	☐	☐	☐	☐

8.4 Annexe D: Universities sample

8.4.1 Spanish universities (from the OTRI network)

UNIVERSITY NAME	*COUNTRY*	*FROM...*
University CEU Cardenal Herrera	Spain	OTRI Network
Universitat Poltècnica de València	Spain	OTRI Network
Universidad del País Vasco	Spain	OTRI Network
Francisco de Vitoria (Madrid)	Spain	OTRI Network
Mondragon University	Spain	OTRI Network
Universitat Abat Oliba CEU	Spain	OTRI Network
University of Cádiz	Spain	OTRI Network
Universidad de Cordoba	Spain	OTRI Network
Universidad Católica de Ávila	Spain	OTRI Network
Universitst de Lleida	Spain	OTRI Network
Universidad de Huelva	Spain	OTRI Network
Universitat Internacional de Catalunya	Spain	OTRI Network
Universitat Jaume I	Spain	OTRI Network
Universidad de la Rioja	Spain	OTRI Network
Universidad de Málaga	Spain	OTRI Network
Universidad de Navarra	Spain	OTRI Network
Universidad Nacional de Educación a Distancia	Spain	OTRI Network
Universidad de Cantabria	Spain	OTRI Network
Universidad Pontificia Comillas	Spain	OTRI Network
Universitat Pompeu Fabra	Spain	OTRI Network
Universidad Pública de Navarra	Spain	OTRI Network
Universidad Pablo de Olavide	Spain	OTRI Network
Universidad Rey Juan Carlos	Spain	OTRI Network
Rovira I Virgili University	Spain	OTRI Network
University of Salamanca	Spain	OTRI Network
Universidade de Santiago de Compostela	Spain	OTRI Network
San Jorge University	Spain	OTRI Network
Universitat de València	Spain	OTRI Network
Universidad de Valladolid	Spain	OTRI Network
Universidade de Vigo	Spain	OTRI Network
Universidad de Extremadura	Spain	OTRI Network
Universitat de Girona (UdG)	Spain	OTRI Network
University of Alcalá	Spain	OTRI Network

8.4.2 Rest of European universities

UNIVERSITY NAME	COUNTRY	FROM
Graz University of Technology	Austria	FINPIN
Aalto University	Finland	FINPIN
Cork Institute of Technology	Ireland	FINPIN
MCI Management Center Innsbruck	Austria	ECSB
Norwegian University of Technology and Science	Norway	FINPIN
Universidade Catolica Portuguesa	Portugal	FINPIN
University of Economics in Katowice	Poland	FINPIN
University of Maribor	Slovenia	FINPIN
University of Thessaly	Greece	FINPIN
University of Turku	Finland	FINPIN
University of Twente	Netherlands	FINPIN
J.J.Strossmayer University of Osijek	Croatia	ECSB
University of Warwick	UK	FINPIN
Aston University	UK	FINPIN
Ecole superieure des Technologies Industrielles Avancees (ESTIA)	FRANCE	GEM
Fhaustria Joanneum - University of Applied Sciences	Austria	GEM
GEA College of Entrepreneurship	Slovenia	FINPIN
Instituto Politécnico de Leiria	Portugal	FINPIN
JAMK University of Applied Sciences	Finland	UIIN
Leuphana University of Lüneburg	Germany	UIIN
Norwegian University of Life Sciences	Norway	FINPIN
Politecnico di Milano	Italy	FINPIN
Riga Business School	Latvia	FINPIN
Saxion University of Applied Sciences	The Netherlands	FINPIN
University of Applied Sciences and Arts Western Switzerland	Switzerland	FINPIN
Swansea University	Wales	FINPIN
Technological Education Institution of Serres	Greece	FINPIN
Teesside University	UK	FINPIN
University of Cracow	Poland	FINPIN
University of Gothenburg	Sweden	FINPIN
University of Greenwich	UK	FINPIN
University of Limerick	Ireland	FINPIN
University of Nordland	Norway	GEM
University of Southern Denmark	Denmark	GEM
University of Tuzla	Bosnia-Herzegovina	GEM
University of Wolverhampton	England	FINPIN

8.5 Annexe E: Assessment of the measurement and structural model

8.5.1 Model 1: Direct impact on Entrepreneurial University's results

OUTER LOADINGS

	ACADEMIC ENTREPRENEURSHIP ACTIVITIES	EXTERNAL ENVIRONMENT	INTERNAL ORGANISATION	SUPPORT MECHANISMS
ASO	0,6312	0	0	0
CONSULTING	0,6003	0	0	0
E_CURRI_ACTIVITIES	0	0	0	0,7708
E_EDUCATION	0	0	0	0,7388
E_FUNDS	0	0	0	0,8197
E_STAFF	0	0	0	0,6662
INDUS_CONTEXT	0	0,9037	0	0
INDUS_CURRI	0	0	0	0,7307
IND_MOBILITY	0,688	0	0	0
INFO_DISSEMINATION	0,8727	0	0	0
INST_CONTEXT	0	0,8886	0	0
INTERNATIONALISATION	0	0	0	0,7678
I_TRAINING	0,7179	0	0	0
MANAG_SUPPORT	0	0	0,8987	0
METHODS	0	0	0	0,7632
NETWORKING	0,8198	0	0	0
ORGANI_DESIGN	0	0	0,8067	0
PATENT_LICENSE	0,6024	0	0	0
POLICIES	0	0	0	0,7668
PR_RESEARCH	0,5649	0	0	0
SSO	0,7422	0	0	0
STRATEGY	0	0	0,8998	0

FORNELL-LARCKER CRITERION

	EXTERNAL ENVIRONMENT	INTERNAL ORGANISATION	ACADEMIC ENTREPRENEURSHIP ACTIVITIES	SUPPORT MECHANISMS
EXTERNAL ENVIRONMENT	**0,8962**	0	0	0
INTERNAL ORGANISATION	0,636	**0,8695**	0	0
ACADEMIC ENTREPRE. ACTIVITIES	0,5924	0,7503	**0,7004**	0
SUPPORT MECHANISMS	0,6726	0,8891	0,7766	**0,75412**

8.5.2 Model 2: Indirect impact on Entrepreneurial University's results

OUTER LOADINGS

	ACADEMIC ENTREPRENEURSHIP ACTIVITIES	*EXTERNAL ENVIRONMENT*	*INTERNAL ORGANISATION*	*SUPPORT MEHCANISMS*
ASO	0,6322	0	0	0
CONSULTING	0,5996	0	0	0
E_CURRI_ACTIVITIES	0	0	0	0,7766
E_EDUCATION	0	0	0	0,7474
E_FUNDS	0	0	0	0,8245
E_STAFF	0	0	0	0,6771
INDUS_CONTEXT	0	0,8863	0	0
INDUS_CURRI	0	0	0	0,7173
IND_MOBILITY	0,687	0	0	0
INFO_DISSEMINATION	0,8724	0	0	0
INST_CONTEXT	0	0,9058	0	0
INTERNATIONALISATION	0	0	0	0,7581
I_TRAINING	0,7174	0	0	0
MANAG_SUPPORT	0	0	0,9032	0
METHODS	0	0	0	0,7672
NETWORKING	0,8201	0	0	0
ORGANI_DESIGN	0	0	0,7987	0
PATENT_LICENSE	0,6023	0	0	0
POLICIES	0	0	0	0,7629
PR_RESEARCH	0,565	0	0	0
SSO	0,7428	0	0	0
STRATEGY	0	0	0,9027	0

FORNELL-LARCKER CRITERION

	ACADEMIC ENTREPRENEURSHIP ACTIVITIES	*EXTERNAL ENVIRONMENT*	*INTERNAL ORGANISATION*	*SUPPORT MECHANISMS*
EXTERNAL ENVIRONMENT	0,700285656	0	0	0
INTERNAL ORGANISATION	0,591	0,896102673	0	0
ACADEMIC ENTREPRE. ACTIVITIES	0,7501	0,6396	0,869597608	0
SUPPORT MECHANISMS	0,7698	0,6735	0,8902	0,754983444