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Aziende accademiche spin-off: un confronto tra Padova e Hohenheim

Academic spin-off companies: a comparison between Padova and Hohenheim

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Firma dello studente

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Syllabus

To my family…

ABSTRACT IN ITALIANO

Negli ultimi trent'anni, si è sviluppato un interesse crescente dell'Unione europea verso nuove misure per migliorare il rapporto tra i centri di ricerca e l'industria. Sono state introdotte diverse politiche per sostenere la ricerca e il trasferimento di conoscenze nel settore industriale. In particolare, le università hanno guadagnato enorme rilevanza per lo studio di nuovi metodi per incoraggiare l'innovazione e la crescita di aziende promettenti. Questo studio indaga sul fenomeno degli spin-off accademici quali società che hanno come obiettivo lo sfruttamento economico dei risultati della ricerca, in cui l'università deve consentire la partecipazione dei suoi membri permanenti o temporanei e fornisce servizi e strutture che possono essere utile allo sviluppo dell'impresa. Tenuto conto di queste premesse, lo studio è indirizzato ad analizzare le aziende spin-off accademiche dal punto di vista dei fondatori per mostrare quali sono le principali difficoltà che devono affrontare decidendo di creare una società con il sostegno o la partecipazione dell'università al capitale sociale. Quindi, come viene gestita la combinazione di competenze diverse con la cooperazione dell'università attraverso le attività di mentoring o l'offerta di infrastrutture e così via. In particolare, lo studio mira a dare luce alle differenze tra la realtà italiana e la situazione tedesca. Sembra essere un argomento molto interessante relazionare un Paese come l'Italia, con il suo grave problema di burocrazia e il modello "*Latecomer*", con la Germania che rappresenta una nazione leader nei settori dell'innovazione e della tecnologia e in generale di tutta l'Unione Europea. In questo elaborato, un quadro concettuale viene stabilito nei primi due capitoli analizzando diverse definizioni di spin-off, le caratteristiche del team e la sua formazione, proseguendo con l'analisi del TTO e dei vari attori che entrano in gioco durante il processo di spinning-off. Nel terzo e quarto capitolo si cerca di affrontare le condizioni di spin-off accademico in Germania e in Italia, considerando due regioni di riferimento e due università in particolare: Baden-Württemberg e l'università di Hohenheim e il Veneto e l'università di Padova. Infine, il quinto capitolo riporta il caso pratico in cui i due paesi vengono confrontati evidenziando le principali differenze e somiglianze del processo di spin-off nelle due università. L'obiettivo di questo capitolo è quello di apprendere dove l'Università di Padova dovrebbe migliorare il proprio sostegno a queste società e capire quali sono gli ostacoli e i vantaggi pratici che la squadra di giovani ricercatori o professori deve affrontare. In particolare, è interessante capire se sia una buona idea collaborare con l'università o sarebbe meglio costruire un'azienda al di fuori del campo accademico.

INTRODUCTION

In the last thirty years old, there has been an increasing interest towards the development of relationships between research centers and industry, which is as a major tool to promote innovation and regional development. The European Union, as well as different countries around the world, has implemented a number of policies supporting the transfer of knowledge from university to the industrial sector. This "transfer" can help firms increase their innovative capacity and face the continuous challenges of globalization and technology change. In addition, important university industry connections are the cultivation ground for the development of new high-tech and high value-added sectors.

From a theoretical point of view, various studies have demonstrated the convenient relationship among investments in research and innovative areas of universities and the economic growth of specific territories. The awareness of operations through which research based knowledge from universities and research institutions gushes all over the society is paramount to grasp technological progress and economic and regional improvements. University spin-offs are among the most powerful instruments for the rejuvenation of the economy. According to Shane (2004) there have been different opinions about the spin-off phenomenon. The critics are about the staving off of the primary function of universities (teaching), in order to commercialize research. Besides, others complainers are investigating if it is fair that researchers obtain valuable government grants for their findings. Despite of these debates, many governments all over the world are focusing on the promotion of university technology transfer, and on spin-offs in particular. Governments are trying to develop measures to effectively exploit these unique companies. Indeed, one of the first obstacles to the development of these companies is the lack of commercial resources in the university environment.

This study aims to give particular attention to the individuals who stand behind these processes, academic entrepreneurs, who develop great ideas at university and decide to put them into practice.

An increasing number of academic spin-off firms have been formed during the last years: in Italy there were about 80 spin-offs in the period from 1991 to 2000, while now there are about 1196 new spin-offs (Spin-off Italia, 2017)[1]. There is a clear sign of a reversal of the trend, as the amount of spin-offs is progressively growing. Moreover, actions for and implementation

[1]See Excel file from this webpage: http://www.spinoffricerca.it/?q=download

of measures for the protection and support of innovative ideas continue to require more work and adjustment for fitting the constant changing market's trends.

Given this premises, the study analyze academic spin-off companies from the point of view of the founders to show which are the main difficulties they have to face when they decide to create a company in which the university has a share of capital. In particular, the work aims at highlighting how different skills are combined in the university spin-offs and which is the support provided by the university during different stages of the development of the spin-offs. In order to do so, the study focuses on the comparison between two case studies, one coming from a German university and another coming from an Italian university. The comparison helps to shed light on how two different institutional systems provide different opportunities to the development of university spin-offs. In particular, we compare a well-organized country in which the support to university spin-offs has a relatively long tradition – Germany – with a latecomer such as Italy.

In the first chapter, a conceptual framework is established, starting with the analysis of the spin-off definitions that have been put forward by several authors from the beginning of the phenomenon in the U.S. to the new typologies of academic spin-off which has been launched nowadays. After the definition of an academic spin-off, both at international and at European level, we explore the typologies of academic entrepreneurs that have been presented in the literature, and the main features of the spin-off creation and development. In order to properly conduct the review of the literature, various sources have been consulted. Among them, academic papers, essays, newspapers' articles, academic journals, handbooks.

The second chapter deals with the different actors who play a crucial role in the spin-off process. In particular, this chapter aims to outline the role of the technology transfer offices (TTOs) as the first tool the team of a spin-off uses for finding support and advisement. Afterwards, the university environment is investigated with its advantages and disadvantages of being a teaching institution and not an entrepreneurial area. Particular attention is devoted to the venture investors – Venture Capitalists and Business Angels – which can play a role in the development of the spin-off. We also highlight the differences between these two actors, even if it is not very clear in the literature. Then, the chapter moves to explain what are the Science Parks and Incubators and in which ways they can be a resource for spin-offs firms. Finally, a general overview is given to the relationship between the governments and the industry which bounds inside the spin-off environment.

The third chapter addresses the phenomenon of academic spin-offs in Germany. In particular, we focus on the region of Baden-Wurttemberg, which is one of the most powerful areas of

Germany. In this chapter, the main governmental and regional funding programs for spin-offs are reported and analyzed. These funding schemes ensure a proper support and development of innovative ideas born in the university environment. The chapter closes with a particular focus on the University of Hohenheim, in Stuttgart, where the major part of the study was conducted. We interviewed the personnel of the TTO and some companies which have been founded by university student or researchers, and the chapter reports the main findings coming from these interviews.

The fourth chapter focus on the Italian situation and on the University of Padova in particular. This chapter reports the main findings of a study that were previously carried out by a group of university professors during the development of a research project (Caloffi et al., 2013).

Finally, the fifth chapter presents the comparative analysis between the two universities and highlights the main differences and similarities of the spin-off process in the two universities. The aim of this chapter is to learn whether and how the support to spin-off companies could be improved in the university of Padova.

CHAPTER 1

REVIEW OF THE LITERATURE

1.1. Introduction

Literature related to the spin-off phenomenon is vast and it provides a basis for the study and comparison of spin-offs companies between the University of Padua (Italy) and the University of Hohenheim (Germany).

The theory about spin-offs companies mostly develops over empirical observations of the most successful cases which are located in the US rather than Europe. However, in the last decade we have seen a rapid development of new high-tech spin-offs companies also in Europe.

University spin-off firms, also known as "university spin-outs" or "research-related start-up ventures", are crucial for the transformation of the economic situation of a country. The typology of university spin-off or start-up that we take into account can be quite heterogeneous, as it can differ with respect, for instance of the role of the university sponsorship and its involvement in the company`s creation, the type of knowledge used and co-localization of the founders (Bathelt, Kogler, Munro, 2010). In this chapter we will describe the phenomenon of university spin-off companies as a company whose goal is the economic exploitation of research results, in which the university has to allow the participation of its permanent or temporary members and it has provide services and facilities that can be useful to firm's development. In particular, university spin-offs are identified by dynamic interactions between different subjects across the various phases of the process. During these stages, the business models is changed due to the improvement of the entrepreneurs` knowledge and the growth of opportunities and resources. Moreover, the team of entrepreneurs transform itself throughout the steps and that required a change also in the typology of resources. The complexity of the phenomenon is well-known from the several actors and factors that influence the evolution of the spin-off company and its different and confused aims (Rasmussen, 2011).

In this chapter we are going to study the phenomenon, trying to report some definition of what is an Academic spin-off company and which are the stages that it has to face during its development.

1.1.1. University Spin-Off Phenomenon

During the past decades there has been an increasing interest in the commercialization of publicly-funded research at U.S. and European Universities. Universities have a long history of generating inventions with commercial value, which are used by industry. And yet, it has only been since the 1970s that TTOs dedication to commercializing inventions have become commonplace at research universities (Kenney and Patton, 2008).

Normally, the main means to transfer and commercialize technology knowledge are patents, research joint ventures, licences and, the more recent phenomenon, the creation of spin-off companies. We have also seen a development in the formation and utilization of science parks, incubators, and different property-based institutions created to support and encourage new-technology based firms.

If you compare those financed by Americans institutions and universities, the spread of these new high-tech firms has developed in delay in Europe. The case of U.S. successful spin-offs companies is well known all around the world and there are a lot of studies about them. The U.S. were the firsts to discuss and apply a proper legislation to protect and help these kind of companies thanks to the Bayh-Dole Act of 1980[2]. This legislation promoted the patent system, utilization of inventions arising from federally supported research or development and to encourage the diffusion of new technologies and innovation thought firms. U.S. legislation has improved a lot since the Bayh-Dole Act and now they are the leaders in this field (Lockett, Siegel, Wright, Ensley, 2005).

The delay of Europe in this sector has to be attributed to the adoption of a new legislation ten to fifth-teen years later than U.S. and also because of its heterogeneity among member's countries and the lack of experiences, skills and competences.

However, there are a lot of very important cases of Spin-offs companies also in Europe, above all in U.K. and in the Northern Countries.

Even if the number of research spin-offs is going to increase, it is not beyond belief that they will be left to a small group of new entrepreneurial companies. We can argue these reasons in different ways. First of all, spin-offs are developed especially in the biomedical and the information technology sectors. The reason of that is not explicit, maybe it might be due to low costs of entry, small scale economies, the strong relationship between industry and research, or the fact that it is easier for companies to work as research consultants and at the same time invent innovative products and services. The fact is that not every discipline is able

[2] see also: https://www.gpo.gov/fdsys/pkg/USCODE-2011-title35/pdf/USCODE-2011-title35-partII-chap18.pdf

to generate new ideas and develop new firms as some others do. Then, spin-off companies usually originate from the few best research institutions. There can be some cases where spin-offs firms are not like that, but it is very difficult, because the parent institution has to carry on a long and expensive process and for the smaller support structures sometimes it is not worth enough if they cannot generate a great portion of intellectual property to justify all the efforts and the staff's expenses.

Finally, the top institutions probably have an upper limit of the number of spin-offs firms that can help due to the conflicting demands placed on their faculty and staff. Besides, there exist other ways of technology transfer and commercialisation different from the spin-offs method. The licensing of commercially relevant technologies can be an exhaustive example; it has the benefit of being less time-intensive for research personnel.

On the other hand, the interest of public officials and universities in spin-off creation will remain very strong. Spin-off policy is not only the commercialisation of publicly funded technologies. In fact, Governments work on spin-offs as a mean to encourage regional development, to spread networking through research institutions and local firms, to nurture new technology industries, and to build dynamic environments helpful for all types of entrepreneurs.

Politicians and research institutions have a lot of interests in the spin-offs process because it represents a unique way of empowerment for the economic sector of a country. One of the main cause is that spin-offs might operate more as mediators in the relationship between industry and research than as product innovators. For example, one of the aims of university spin-offs companies is the commercialization and transfer of entrepreneurial opportunities as an enrichment process for the university itself and also for the economic sector of the region in which they're operating. This is an example of the case "Learning-by-doing", in fact, if one university project will succeed, others will follow and invest in new researches.

Several researches found that research spin-offs are more successful and more active than their matched controls at obtaining public support for research and innovation activities. Hence, the initial endowment and knowledge passage from the parent institution would demonstrate the higher innovation performance of spin-offs. Research spin-offs have a fundamental role in the development of the innovation field, but their financing and enforcement must be taken into consideration for a broad policy combination which cultivate an entrepreneurial business background and improve networking through universities, industry and the public sector[3](Andreas Stephan, 2014 and Alf Steinar Sætre, Ola Thomas Atkinson, Beate Kristin Ellerås, 2004). As a consequence, there is a noticeable concern

[3] See also: http://www.oecd.org/sti/sci-tech/introductionthenewspinonspin-offs.htm

among U.S. and European policymakers and university administrators in analysing the managerial and policy implications of this trend (Lockett et al, 2005).

1.1.2. University spin-off definition

University spin-off firms, also named as 'university spin-outs' or 'research related start-up ventures', are indicated in the literature as one of the main expression of the economic transformation and growth (Bathelt et al 2010).

Spin-offs are also seen as a way to spread knowledge across research institutions and industries, so they contribute to the formation of knowledge spillovers (Stephan, 2014).

Hence, the definition of this phenomenon is not uniform around the countries.

From a terminology and definitional point of view it is possible to observe in the literature a strong heterogeneity of positions on the concept of academic spin-off and even on the name given to the phenomenon there is a plurality of terms. As a general category, many authors agree in defining the spin-off as a process through which constitute a new independent business in involving parties who work or have worked in another organization (Piccaluga, Chiesa, 1996; Arrighetti, Vivarelli, 1998; Lindholm, 1997).

Another definition is that university spin-offs are seen as new ventures that count on licensing or appointment of the parent institution's intellectual property for initiation (Lockett, Wright, 2005).

Helm and Mauroner (2007) described a spin-off company as a technological start-up company arising from a firm or a public research organization. These kind of research-based spin-offs are founded by at least one scientist from one of these research institutions or universities and their aim is to focus on scientific findings and their transformation in marketable processes or products. The original founders may exit their parent organizations or keep the relationships while constructing a new firm.

Another definition is stated by Clarysse and Moray (2004) in a two-dimensional way: a spin-off is a new company that is constituted (1) by a faculty member, staff member, or student who moved from the university, and/or (2) a core technology (or idea) that is relocate from the parent organization. Thus, in relation to this statement, a spin-off can be described as a technology transfer mechanism for the commercialization of a technology created at an R&D institution or university.

Despite these simple definitions, the real relationship between the spin-offs companies and the parent institution is not always so clear and constant. Therefore, some authors suggested to encase the definition of spin-off company to different situations; e.g. restrict the description to include specific transfer, so that it is possible to talk of "Technology spin-offs", or "Founder spin-offs", or again "Venture capital spin-offs" (Carayannis et al, 1998).

This is the reason why we cannot bring back the definition of spin-off to a unique situation and also because the structure of spin-offs processes or companies differ across countries. In this paper, we will analyze the different steps and definitions of a spin-off process between the two universities protagonists of the survey.

Thence, we can summarize some common characteristics among the different definition of the spin-off phenomenon:

- The parent organization, from which a new innovative company is created, usually is a university or academic institution.
- The part of the company that is represented by a spinoff has to be an apart legal body. Hence, it must not be a development of an entity or a controlled department of the university.
- The new body has to use the knowledge derived from universities' works or academic's aims.
- The goal of the spin-off is the generation and commercialization of technology (Pattnaik, Pandey, TIM Review, 2014).

Research institutions usually use this mechanism of spin-off when there is no real business to embark on about some projects in a specific field of work or also about some ideas that have the potential to become marketable products and applications, thus, with an economic value.

Rowland and Knowles (2010, pg. 4) from the University of Manchester defined this process in their guideline to create Spin-offs Company, as "platform opportunities" or "disruptive technologies":

"Creating a spin-out company is a fundamental decision. It will have ramifications for you as a researcher which you have probably not yet considered".

1.1.3. Types of university spin-offs companies

The first distinction that we have to do is between start-up companies and academic spin-offs companies. These firms have some features in common and deal with analogous problems in

creating market legitimacy and growing up. Notwithstanding, university spin-offs companies differ from these kinds of high-tech start-ups for two main reasons. In the first place, unrelated their counterparts that spin-offs from the private sector, the latter is emerging from a non-commercial field. As we mention before, the process of spinning off academic companies doesn't have the same resources and skills of the private sector. Whereupon, the goals of the participants of the academic spin-off company may be different among them (e.g. the manager interest vs the university aim); this can be a real difficulty to succeed in the real market (Bathelt, Kogler, Munro, 2010).

Müller (2008) made another distinction between three types of spin-offs companies:

- Research-based transfer spin-offs: the results investigated, during the process of spinning-off the company, are conducted by at least one of the founders (highest intensity of technology transfer).
- Method-based transfer spin-offs: new scientific methods must be acquired by one of the founders and they must be fundamental for the new firm creation (medium intensity of technology transfer).
- Competence spin-offs: specific skills learnt by at least one of the founders must be indispensable for the new firm growth (low intensity of technology transfer).

We can also distinguish between the Orthodox Spinout, where the company is created by one or more academics leaving their role inside the university to work only in the new firm. Further, we have the technology spin-off category in which an external investor/manager acquires or leases the IP from the university and originates a new firm. Finally, we have the Hybrid Spinout that is a set of the previous two groups (Sætre, Atkinson, Ellerås, 2004).

1.2. Members of the Spin-off

An academic spin-off company has to obtain a set of capabilities and skills blending both the scientific orientation and the business orientation. The former is useful for discovering and developing technology, whereas the latter is necessary for making marketable the product or service that include the technology. Thus, if we relate this concept to the team formation and composition, we are able to distinguish some precise features of this kind of firms. According to some studies, company attitude and outcome is concerned to the cognitive peculiarities of the top managers and these characteristics vary depending on age, education, experience, functional background ("demographic approach").

Following the recent research about spin-off companies' formation, it has been found that one of the main factor that can influence deeply the success of these new venture is the characteristic of the entrepreneurial-managerial group. Besides, organizational features of new firms may encourage coordination between direct supervision, power and authority and capacitate more carefully strategic planning and more adaptable and effectual environmental scanning. Moreover, technology-based ventures, especially university spin-offs, are normally created and managed by entrepreneurial teams rather than single individuals. Their success is related to the full capitalization of the available technology as a core source for the competitive advantage; this is the reason why it is so important to integrate technology characteristics and business strategy. Teams of entrepreneurs are more able to face the huge level of uncertainty and risk typical of this science-based sectors.

For this motive there are a lot of studies investigating the characteristics of entrepreneurs and team of entrepreneurs, because it is relevant to understand how a spin-off company can improve its performance and succeed in the real market (Visintin and Pittino, 2014).

1.2.1. Entrepreneur's Features

The individuation of the entrepreneur's success features is an old theme almost as the research in the social science field. In the 1912, Schumpeter, the first "Innovation researcher", underlined the economic progress in the activities of some subjects called entrepreneurs with skills and capabilities which were superior to the average and defined as "the agents of innovation". The studies about the entrepreneur's characteristics continued for a lot of years analyzing personal features; familiar background and education. The empirical results of all of these studies showed that an individual become entrepreneur at the age of 30, after he has developed some experience in the field. The data, relatives to the academic spin-off, confirms the importance of specific features experienced in the working environment, while they also demonstrate a rise in the average age (42) when individuals transform themselves in entrepreneurs. At the basis of the choice to be an entrepreneur in the academic spin-off field there is the willingness to success, the desire of independence and the wish to earn more money. The values and the motivations are influenced by the institutional reference group (departments or research group), in which members can express, more or less, explicit judgements about the legitimate perception of commercialization of the scientific research's results (Compagno and Pittino, 2006).

The nature of the entrepreneurs is crucial to demonstrate spin-off generation and prosperity. Besides, the university environment performs a powerful job, both in correlation to the individuals operating university spin-offs and their companies. Several university attributes related to the spin-off creation are well validated in the literature, e.g. intellectual eminence, faculty quality, scientific productivity. Moreover, the role of the entrepreneurs is engraved by their starting background. In this fashion, it is proved that the university-level characteristics work upon the conception of new venture and the kind of these companies (Rasmussen and Wright, 2015).

The entrepreneurial potential that a researcher can express is also influenced by a number of critical factors associated with personality traits typical of subjects engaged in the academic environment.

It may be difficult for a researcher to acquire a set of cognitive patterns that are typical of market orientation and to coexist with a cultural approach focused on scientific speculation. The rules, times and modes of science are often perceived as incompatible with market laws and the coexistence of these two logics is consequently very difficult. Cultural resistance to market orientation is at two levels. The first level constitutes a fundamental resistance and derives from legitimate ideological position that interprets the University's mission as an exclusive producer of non-marketable public knowledge for private ends.

The second level of resistance concerns the priority that the researcher tends to assign to the scientific value of his activity. This attitude can lead him to systematically underestimate problems related to translation of scientific results into products/services whose utility is actually perceived by potential customers.

Risk attitude is another important feature of the entrepreneurial profile that is often not found in academic subjects. Several research points out how the sensitivity to risk from the researchers facing the market depends on the choice that is exercised over academic careers. If the researcher considers the prospect of leaving the institution of belonging, he will be particularly sensitive to the financial risk characterizing entrepreneurial activity. The researcher, in fact, leaves a totally secure job from the point of view of the position and the economic recognition, to invest in the uncertain returns of the entrepreneurial initiative. If the academic position is not abandoned, the perception of financial risk goes far behind, while the professional and social risk are assuming major importance, stemming from the fear of undermining its reputation in the academic context and unduly undermining scientific production to the advantage of the commitment in the new business (Compagno and Pittino, 2006).

Anyway, the types of entrepreneurs that have been individuated in the literature and in several studies are essentially two: the academic entrepreneur and the surrogate entrepreneur. The former category is represented by the inventors, while the latter is described as the group of people that didn't invent the technology, they only get the rights to commercialize it from the university. The academic entrepreneurs are often very committed in the new venture, they work hard on their inventions and knowledge. However, the disadvantage of having only academic entrepreneurs that guide the venture is that they usually have scarcity of managerial and business competences to drive the venture to the success. This is the one of the main barrier that a spin-off company has to overcome to be ready to enter the market. Conversely, the surrogate entrepreneurs, those that have managerial skills, often lack of technology knowledge (Sætre, Atkinson, Ellerås, 2004).

Other definitions by some authors have found similar procedures to entrepreneurship related to the creation of innovative spin-offs companies financed by universities or other institutions: the inventor-entrepreneur approach, also known as academic entrepreneur approach, and the surrogate entrepreneur approach (Franklin, Wright, Lockett, 2001).

In the former case, the academic is the technology driver and he/she can adopt the role of the entrepreneur. In some cases, they quit the university to manage the new project, while in others they work in a parallel way both in their role at the university and in the company. The involvement of the university entrepreneur may have some advantages like put more commitment, ideas and knowledge of the technology in the new spin-off company. On the other hand, they may investigate in too deep way on the technical features of the innovation to the damage of business environment (Lockett et al, 2003). It is demonstrated that companies which break the bounds with the university have grown more.

Another problem may be the fact that academic entrepreneurs have also to work as heads of department or deans of faculties, so they may not have time to do both jobs. Additionally, the inventor (the person that identify the innovative opportunity), may not be the same person who develop the ideas, skills and abilities to commercialize the product or the service. To beat these disadvantages, one strategy might be to invest in the surrogate entrepreneurship. Thus, an external person that will work as an entrepreneur in parallel with the technology originator who continues to operate inside the university. These individuals can be first time entrepreneurs exiting occupation in industry to make out and build university ventures. Normally, the university pay these individuals a salary related with what they usually get in industry, until the time in which the project can be transform in a full-time venture. The university, instead of hiring only one external individual, can also assume a company to operate in this field, while the academic entrepreneur maintains its role within the institution.

This approach has been introduced in the mechanism of spin-offs companies creating because of the difficulty to break the relationship with the parent institution, in particular around the academic entrepreneur role (Franklin, Wright, Lockett, 2001). The surrogate approach can be an advantage as well as maintaining a link with the capacity to develop further technology. In fact, there are solid grounds which attest that the more lucrative universities may be those which have designed a solid procedure to involve surrogate entrepreneurs in the management and invest in new technology-based spin-offs ventures. Nevertheless, the academic entrepreneur in this view usually covers an advisory role for technical aspects (Lockett et al, 2003).

Another factor influencing the choice between the two approaches is the development of the university itself. Indeed, new universities tend to have a poorer research fame than older institutions and they have not the resources to finance new ventures. Besides, they are also overwhelmed by bureaucracy procedures, so they're less flexible and the commercialization activity might be not developed as that of older universities (Franklin, Wright, Lockett, 2001).

Especially in Europe, the constitution of new firms is spreading across countries, but there also a lot of differences between them. A lot of surveys have been done in this field trying to understand why some institutions work better than others, but the only bright pattern seems to be the historical success that can brings to future powerful projects. Despite the fact that a disparate number of universities have prospered in the entrepreneurial sector, European universities still have to put a lot of efforts in developing these managerial skills and succeed in the real market (Rasmussen and Wright, 2015).

The concept of surrogate and academic entrepreneur vary through universities and countries, so a common conclusion cannot be made. As the spin-off phenomenon is different in its way, also the entrepreneurial idea can change and has diverse interpretations (Sætre, Atkinson, Ellerås, 2004).

In the light of the criticisms outlined, it is understood how the evolution of the personality and skills of researchers towards more oriented entrepreneurship can be effectively promoted through formative activities and awareness-raising actions carried out both at the level of individual research institutions and system level. However, in the case of technological start-ups and academic spin-offs in particular, the launch of a new venture has almost never been the result of a single individual initiative. The development of a business project is often the culmination of years of research by a team. The analysis of dynamics characterizing the teams is therefore crucial for a thorough discussion of the subject (Compagno and Pittino, 2006).

1.2.2. Team formation and characteristics

The composition of the team of entrepreneurs is fundamental for the success of the spin-off company. The establishment of a new company is a complex process that has to go through different phases with several influencing factors which affect the timing between leaving university and the creation of a spin-off. There are a lot of studies about why some spin-off companies are more flourishing than others and one interesting theory is that from Lazear (2004) that demonstrates which people are more prompt to build a business. This theory illustrates how an entrepreneur has to be jack-of-all-trades, namely those who work for others can specialize in one skill, but entrepreneurs are limited by their weakest skill. Let's take two skills, x1 and x2. To make this real, let income of specialists be given by:

- Income of specialists = max(x1,x2)

And

- Income of entrepreneurs = min(ʎ1,ʎ2)

Where ʎ is a market determined parameter that sets the price of entrepreneurial capability to balance supply and demand. This formulation underlines the fact that entrepreneurs must be capable at a number of different skills to manage a business together. Individuals are endowed with some basic ability, but they also can enrich those skills by getting determinate types of human capital. Individuals should invest in the skills where they are not good. Lazear's theory studied skill complementarities which are, in particular, important for entrepreneurs. For example a scientist that has not-equate skills profile has to get them as management skills before creating his own firm becomes worthwhile. This is a waste of efforts and it causes an increase of the length of time between the leaving of the academia environment to access the real market opportunities. An individual with a good mix of skills would have more success than an individual with unbalanced knowledge. This permits a fosterage of Lazear's theory to demonstrate the time-lag of academic spin-offs.

The creation of a variegated team of founders is an intelligent alternative to acquiring the whole complementary skills. Besides, to make the growth of a spin-off company faster, there is the need from one of the team members to show a skill profile that is featured by a mix of capabilities rather than a specialization in one single field.

The discovery of a great opportunity in the real market can be more difficult than in the academic environment, because the "window of opportunity" will close more quickly in the open market where there are a lot of competitors rather than in the university's laboratory (Müller, 2008).

Howsoever, a lot of studies have underlined that early-stage venture capital funds use the "business experience" of the teams as the most important way to contemplate investment. Hence, several high-tech start-ups and in particular research-based spin-offs do not obtain funding due to the lack of experienced manager working in the team (Clarysse and Moray, 2004).

Other studies analyzed the differences between the tasks in each stage finding that in earlier phases the dominant tasks are product and technology development, securing finance and strategic positioning in a new product-market segment, while in the final stages they found that acquisition of additional resources, sales and marketing and organization and administration are the fundamental tasks (Bjørna and Gulbrandsen, 2009).

In the first phase, of a newly start-up, the main task is the further development of the technology using customers as the most relevant start-point of information. Thus, technical business development stays a major activity of the CEO. Normally, the members of the founding team have already meet each other before the creation of the firm and often there is one individual as the lead entrepreneur who was the technical project manager before start-up. Additionally, these individuals have a weak network with non-experts people when they are starting the new firm and they also have not much experience in the industry environment. This is the main reason why about Clarysse and Moray's studies (2004), investors initially are very skeptic and they only decide to put some money in these companies when they themselves can hire a functionally balanced professional team that can substitute the starting team at the managerial level.

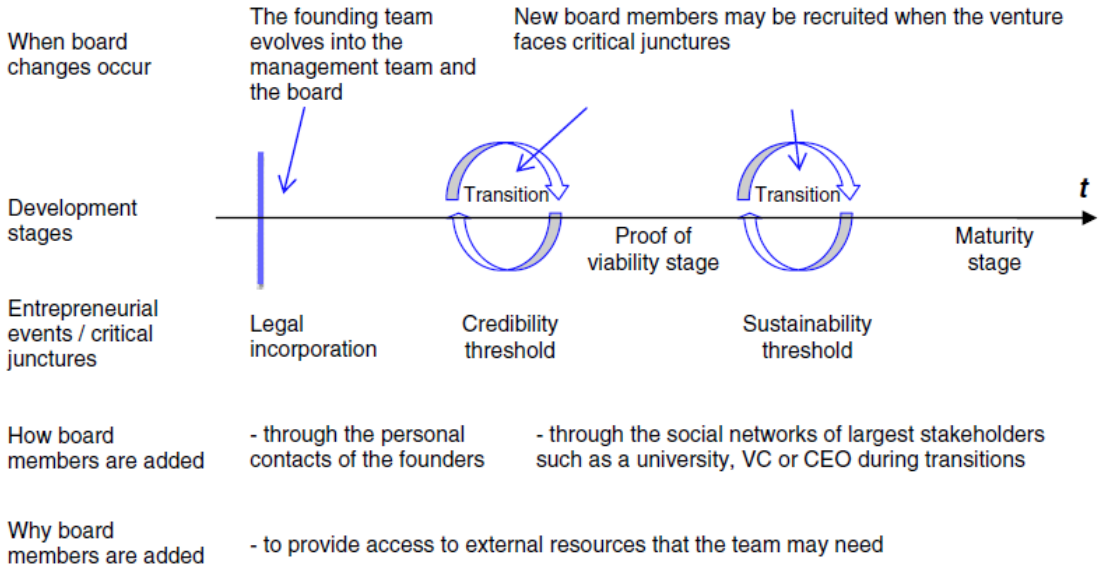
This way to manage this new kind of companies was possible until some years ago. Nowadays the competition in the field is very intense; these new firms usually begin their activities getting the managerial support from the financial investors, specialized service providers, incubators, or venture accelerators with whom they work or by whom they are supported.

One important point is the individuation of the parent institution; some examples can be universities, publicly or privately funded research institutes and technical schools. In particular, previous studies have found three evolving modes of the founder team: the protected mode, the free market mode, and the Keynesian mode (Clarysse and Moray, 2004). In the former way, the engineers/researchers, that are concerned and they think it is possible to get together for creating a potential spin-off, are preserved from the external environment until formal venture capital can be invested. Commonly, at the beginning these start-ups have a small founding resources to get through the incubation period and stay on the property of the parent institution. In this case, venture capital is arbitrated and a professional start-up

team is created. In the second way, the researchers begin with no financing or only a little amount of it. Thus, they are not being implanted in the parent institution during these stages. The latter mode is related to the research team receiving some starting founds, spin-off, and obtain coaching from the network.

The stage between the movements of the new firm from the pre-start up to the post-start-up phase is known as the legal incorporation. In this era, the founding team transforms into the management team and a board of directors. In the following figure we can look at the different stages that a team has to face.

Figure 1. Integrated Theoretical Framework



Source: Vohora et al. (2004) and Bjørna and Gulbrandsen (2009)

Some studies have summarized the general competencies that the teams has to seek to form a strong company. Normally, academics are very dependent on other individuals in their environment to offer the skills and abilities requested to promote the new firm given the traditionally non-commercial environment in which they work. The most important competencies to be analyzed concern the opportunity identification and development, championing, and resource acquisition. A particular aspect is the key role of human-agency in entrepreneurship and the need of an individual to assume a championing role in the venturing process. Champions, usually, encourage the commitment of others to the innovation by giving emotional significance and force. University spin-offs max be championed by academics, external entrepreneurs or a combination of both (Rasmussena, Moseyb, Wright, 2013).

Hence, the champion is a decisive person during the pre-start-up period and a part of the start-up period of the venture. Previous studies have presented researchers about the influence that

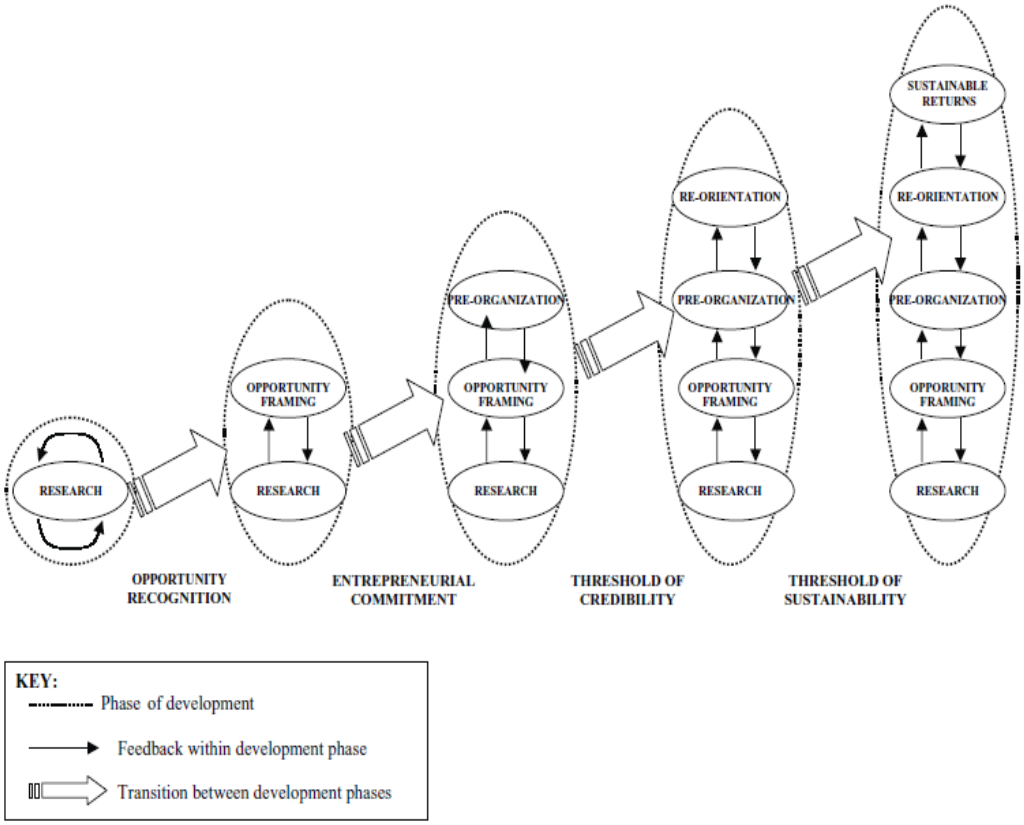
“the champion role” has in the organization and development of a successful idea and business. The champion is that person that can easily identify himself by acting as a “champion” proving indicative personality features, transformational leadership behaviors and influence tactics. However, even if the “champion” is often considered a substantial role for the venturing of a new firm, it is frequently discussed his participation as a stable base needed for long-term growth. In fact, precedent literature stated that new firms quickly overcome the managerial abilities of the founder. As a consequence, if the founder is not being substituted by professional management, outcomes of the new firm is going to reduce through time. Other important roles, to manage projects successfully, that show up in the researchers about the team formation are the technical expert, the sponsor, the project leader and the gatekeeper. Team characteristics as team composition (functional heterogeneity, team tenure and size), team group processes, like the team’s activities and attitudes (internal and external communication) and psychological dimensions, and the last, problem solving styles, have received a lot of attention. The champion paradox can be understood by the fact that the team need time to figure out the goals and organize the project. Actions on the account of the coach could not be undertaken before this “learning” occurred. Hence, learning by doing is the essential way to explain to the team and make them understand the need for external formal leadership.

During the idea and pre-start-up phase, different founding team members and the business idea converge constantly towards the formal legislation of the venture. The level playing field and the rules of the game are built. The start-up phase can be described as the first “revolution” concerning an entire new ambience and changing expectations towards the team members. In this stage, the champion enhance the role of business manager, each engineer or researcher is appointed to a distinct project with particular responsibilities, and the others identify themselves in their belonging places in the company. Even if the learning by doing is important, it will end when the capital growths it for re-orienting the strategy. At this point, the final stage, the professionalization of the management structure evolve into a key factor. The whole process cannot be forced, the team members have to learn and understand with their time what they are doing to allow the planning of an efficient organizational and managerial strategy (Clarysse and Moray, 2004).

1.3. Spinning-out process

In the following paragraph, we are going to explain the main steps that a new spin-off company has to face. Vohora et al. (2004) found five phases that a new spin-off firm has to deal with: (1) research phase: (2) opportunity framing phase; (3) pre-organization phase; (4) re-orientation stage; (5) sustainable returns phase. Every step is describing a determinate set of actions and also is focusing on the activities that the company has to achieve before moving to the afterwards phases. Vohora et al. (2004) stated that, in their studies, firms follow different steps in an iterative non-linear way.

Figure 2. The critical junctures in the development of university spinout companies.



Source: Vohora et al. (2004)

Clarysse at al. (2004) found that the spin-off process is divided into three phases, the first one is named "invention" phase and it is a period where actors suffer of a high degree of uncertainty. The second one is called "transition" phase in which technical uncertainty is slowly disappearing and the business idea is selected and developed. The last one is known as the "innovation" phase, when the project is growing and the idea's foundation is consolidated.

This sequence is seen as a circle because of a lot of projects have an elevated probability to fail. In fact, most of these ideas will not succeed, they will not reach an economic value for a spin-out. Furthermore, in the transition phase only few ideas will show growth possibilities and enroll to the next step, the innovation or business development stage.

In general, we can find in the literature that the first phase is always the generation of a new idea. The entrepreneurial idea comes from an individual or collective creative act that presupposes the ability to seize an opportunity to create value.

The choice to give birth to a research spin-off derives from the will to pursue an entrepreneurial opportunity through the translation of an innovative idea into a business venture. In our perspective, an entrepreneurial opportunity can be defined, at first approximation, as the possibility of creating economic value through new ways of satisfying a need.

The emphasis is on the entrepreneur's ability to identify opportunities by using (new or re-combined) information from the environment (Campagno and Pittino, 2006).

Hence, the creation of a new firm from a parent research organization is a long-lasting process that begin with the innovative idea and concluding with the building of a real enterprise. The steps of spinning-off a new firm are much the same to a common entrepreneurial development, together with the pre-spin-off steps, the spin-off phase and the post-spin-off process. Basically, the former step is characterized by looking through ideas, choosing among alternatives and developing a business plan, while the second step is related to formal legislation and market entry. The last phase regards the establishment of the new company in the market and it consists in technical product evolution, structural change in the company, professionalization of the team and external growth funding.

Besides, during these steps, the success of the company is influenced by three typologies of factors: the individual's skills and capabilities, the environment enclosing the new spin-off and the created spin-off firm itself. Furthermore, we also have to add the influence of the incubator or the parent organization that has a crucial role on the development of the new firm (Helm and Mauroner, 2007).

In the next sections we are going to analyze the different steps of the spin-off process with a particular attention to the problematics and benefits that a new firm has to face.

1.3.1. Pre-start-up phase

The process of spinning-off a new firm is described as the steps where a research-based idea or opportunity, one person or a team of entrepreneurs and the environment, build the fundamental assets for the creation of a new organization. This description also anticipate the most important aspect of the first step: the idea.

The idea comprehends tasks which go ahead with hypothesis formation and it is not very structured; for example imagine a constant researching for individuating new properties that conduct to a potential change. This step is not easy, because ideas are not always without risks particularly when the argument is a scientific or technological research. Thus, the choice among different promising ideas is crucial, even if sometimes the selection is related on a person's irrational conviction to success. This happens mainly across researchers that are used to operate in not centralized or team group environments, skeptical about outside members to look for their results. Hence, the aim of the first step is to convert this not organized group of ideas in a structured one, selecting capabilities and skills to choose the brightest projects and invest on them. When the selection process will finish, the researchers are going to fix the most important parts of their projects or ideas and choose which of them is the right one to develop. Besides, these actors have also to convince "gate keepers" like professors, directors of research centers or companies managers to invest and participate in their ideas.

A serious analysis has to be conducted to evaluate technological, commercial and personal features for exploiting any project. The screening of ideas is going to be a "gentle" one, because of the subjective opinions of the actors that submitted the ideas at the beginning (Elpida, Galanakis, Bakouros, Platias, 2010).

The environment is the primary source of entrepreneurial opportunities and in this sense we can decline on three different dimensions: (1) the economic dimension; (2) the technological dimension; (3) the socio-institutional dimension. If the three dimensions are not sufficiently developed and powerful, the idea is not going to succeed. Another cause of failure is the fact that even if some ideas are very innovative, they are not perceived with an economic value by clients. This lack of value perception is due to different reasons; e.g. the developed technology, despite its inventive features, has not been transformed in a right marketable product or service for the need of the client; or the value of the technology has not been correctly communicated to the potential client; or this technology is too complicated to satisfy a need and in the market already exist simpler product or services that have the same performance. The critical issues for the idea's development are: (1) the high degree of

unpredictable factors and the operational risk which characterized a technology-intensive and innovative activity; (2) the fact that the most valuable asset and the main source of competitive advantage are constituted by the personal capacities and intellectual capital of the founders, which are easily divisible by the prize and cannot be constituted as collateral; (3) the eventuality that the entrepreneur implements opportunistic behaviors by exploiting the fact that only he knows the actual value and potential of technology; (4) the absence of a company's precedent history that could, through accounting statements, constitute a source of confidence for debt stockholding; (5) the optional value, hardly quantifiable, embedded in research projects; (6) the weakness of the signals the investors are using to evaluate businesses, e.g. While for traditional products they can easily use the classical indicators of accountancy and finance; for research project they can use a few methods like CV of the members of the project, publications, patents and obtained research contract (Campagno and Pittino, 2006).

According to Vohora et al (2004) technology university spin-offs, that are usually created by the more successful scientists and inventors in areas where they are not experts in their field, run into particular problems with obtaining strong intellectual property protection for the spin-off.

1.3.2. Start-up phase

After the initial phase, the opportunity recognition, the university technology-licensing office may then decide to pursuit intellectual property protection for the new idea. In this case the TTO can decide to licensing or spinning off the project. Rules and policies related to this phenomenon are different across universities, but in the major part of the situations, established companies are the licensee of university inventions or in some other cases, newly created companies are the licensees. Starting with the initial step, this process entails serious amounts of tough work that bring successful outcomes in a few occasions allowing to the company to pass to the next step (Pattnaik and Pandey, 2014).

In fact, when the opportunity has been found and all the information have been analyzed, the next phase for the entrepreneur (or the team of entrepreneurs) is to look for new resources or to use their skill and endowments to investigate and develop their opportunity. The owner(s) of a business are used to be its fundamental capability and they may be very important due to their experience and knowledge to acquire new resources. Even if resources are crucial to start

an activity, they're not the only significant thing to have. The fact is that resource by themselves are useless to reach a sustainable competitive advantage, so that means that entrepreneurs have to improve their skills and choose competitive strategies to exploit of their resources. There are a lot of studies about this point of view, both from the side of the resource-based theory and the firm-level view. These studies stated that the successful of a new venture depends on the capability of the entrepreneur to use its own skills and resources to achieve a better standard and also by the relationship that has been created with the parent-organizations and research institutions (Ucbasaran, Westhead, Wright, 2001).

The main difficulty in this phase is the decision concerning when to commercialize that depends both to the technology and the academic. Normally, the commercialization step goes on when the technology is commercially viable and an academic wishes to work in the transfer process. Usually, this process is concentrated in the recognition of IP (i.e. verifying patent ownership), in fact, some universities also hire patent attorneys to deal with this problem. Sufficient due diligence is not committed and too much confidence is appointed on the aim of the academic. Universities with less experiences in this field seem to put excessive efforts on the goal of the academic to invest in the venture as a spin-off. The availability of internal professionals is also an important aspect to be take into consideration as in some cases the conduct of due diligence depends on the nature of the discipline. The fact that there is the need of different approaches due to diligence according to the discipline is not recognized in general through institutions of the various countries. Thus, it comes into sight that there is a necessity to create widely spread approaches to due diligence that go beyond verifying ownership of IP to considering the vast set of commercial features of the company. The studies related to the role of the academic in these two first phases underline the requirement for PRIs to improve knowledge in both the academic and TTOs to enable these steps to be obtained with success (A. Lockett et al, 2005).

A third obstacle in this process can be choice between licensing and spin-offs the new company. Universities are experimenting a change towards taking equity stakes in spin-offs rather than licensing fees. The former method is convenient to both the spin-offs and to the university. It gives advantages to the parent institution, because it can receive equity in exchange of the payment of the start-up's patentee fees; so it is profitable for the university due to the fact that it has the opportunity to make earlier profit realization through equity sales (Sætre, Thomas Atkinson, Ellerås, 2004).

The fourth important issue is the timing of the involvement of the TTO over the development phases, but we are going to analyzing the role of this department later (A. Lockett et al, 2005).

After the analysis of the opportunity for technological validity and performance, the academic entrepreneur and the TTOs intent to find different markets, what uses of the technology to develop for these markets and how easily achieve the target goal with the innovation. The ability to understand which of these markets and properties of the new technology must be exploit and spread is the crucial part of this phase. In fact, the lack of skills and knowledge at this point of the development of the idea can represent a hard barrier to overcome. In this very beginning step the cardinal issue is that what universities hold is not what VCs want to get. The fact that universities have a lot of instruments, technologies, general endowments to develop the new firm doesn't mean anything if there is a lack of concept, no proof of market or commercial management.

After that, the company has to stop and deal with the pre-organization. This means that the decisions undertaken in these firsts steps are crucial for the success of the company and this phase represents the steepest learning curve for the academic entrepreneur.

Besides, this is also more relevant if they have not a lot of experience or knowledge about how does the target market works and they have few contacts in the field. Afterwards, the new firm usually had acquired a sufficient amount of knowledge to access the market and feed the start-up obtaining some profits. About Vohora et al. (2004) this is the re-orientation phase where entrepreneurial teams deal with the different tests of constantly cataloguing, getting and amalgamate endowments and after that re-configuring them. If the new firm was equipped with poor resources at the beginning, this part is salient. During the process these entrepreneurs learn how to develop newly acquired resources, information and knowledge and bring together new skills. This is necessary to produce some profits and satisfy customers' needs. The main obstacle is usually understand how to acquire the resources and expertise to reach that lack and also how to coordinate them into the company, this is the challenge of the growth phase. Normally, once the resources have been obtained, the team has to write the business plan.

It is important that new entrepreneurs must have a clear picture of the available public incentives to finance the business initiative and the possible forms of private funding to resort to. At this point, the enterprise, created in the university environment, begins to develop his own marketing strategies, obtaining a position on the various targets markets and entertaining relationships with customers and suppliers facing competition. With the beginning of the management of the company and the start of managerial practices, it is still indispensable to have expert advice from the supervisors that help the entrepreneur in managing the neo-enterprise.

It is here, then, that a third and last category of subjects intervenes involved in the realization of spin-offs, the so-called "power promoters" who are investment companies, business angels, potential clients or even public institutions that implement programs of targeted support. They, once goodness and validity of the idea has been proved, support the promoters of the initiative through the provision of financial, human and material resources.

1.3.3. Post-Start-Up phase

In this final phase the spin-off company is consolidated and it is working well. The spin-off company accomplish sustainable returns. The main goal of the entrepreneurial teams is to retrieve and re-configure resources to mix abilities which allow the firm to achieve that phase. When the newly formed company get to this final step, it means that it has been able to overcome the early obstacles through the settlement of its meticulous business model. During this step there is the necessity for the management team to develop a solid commercial experience to permit to the company to conquer independence from the university as a tangible business. It is very common that a company in this phase proceeds outside the university's campus, maybe exploiting a university affiliated Science Park or incubator. Nevertheless, even if the firm has transferred outside the university's environment, it will continue to have strong links with the academic field. In fact, at least one of the academic inventors usually stays at the university occupied in scientific research while operating as a technical advisor to the new spin-off company (Vohora et al, 2004).

In stage three, that we can call also "stability phase", the growth rate reduces to a level consistent with market growth. The firm's main challenges at this step are to perpetuate growth situation and market position. The typical goal in this part of the process is the investment and work for finding a new product or service to sell in the market or innovate the previous one.

The view in step three must be amplify the final aim of the phases, that is to say the making of economic value by academic spin-offs, constituting both tangible and intangible profits to the local economy. Some studies found that the relocation risk and the non-attainment of the whole industrial capability of technological projects are the main problems for spin-offs companies with a high growth dormant (Sætre, Atkinson, Ellerås, 2004).

In general we can say that critical junctures appear due to the firm needs new allocation of resources, skills, endowments and networks if it is to succeed to the next step of the process.

If these junctures are not faced by the firm as soon as possible, the new venture will not make it. Specifically, we can identify four critical junctures that characterize the entire process: (1) opportunity recognition, (2) entrepreneurial commitment by a venture champion, (3) attaining credibility in the business environment, and (4) achieving sustainable returns within their respective markets (Vohora et al, 2004).

CHAPTER 2

FACTORS INFLUENCING THE SPIN-OFF PROCESS: THE ROLE OF TTOs AND OTHER INTERMEDIARIES

2.1. Introduction

In this second chapter of the paper, we are going to analyse the factors that might influence the process of spinning-off a new company from the university. In fact, technology transfer, id est the commercialization of public research, can occur in different ways. This is one of the main reason why the Technology Transfer Office (TTO) of the university is very important and it has to be studied. Another important factor is also the location of these new high-tech companies, that in order to exploit knowledge spill-over effects, they should locate nearby the parent institution/incubator institution (Muller, 2008). However, other studies found out that the location decision nearby the incubator institution is not crucial for the development of the spin-off company (Egeln et al, 2004).

Studies, about academic spin-off companies, often underline the features of entrepreneurs and the organization for which they have been operating, but it is also very important the influence of external factors like the availability of venture capital and business angels supporting services, industrial relationships and complementary assets. In fact, the spread of powerful internal and external relationships, with sources of scientific and technological knowledge and with industry, is a pivotal factor of prosperity in the development stage (Grandi and Grimaldi, 2002). Academic spin-off companies are new firms changing across a number of steps of activity and they need to improve their knowledge, resources, board structure and processes to allow their products or services to access to the real market (Bjørnali, Gulbrandsen, 2009). As a consequence, studying the actors and the factors that can influence this metamorphosis is determinant to understand how a new high-tech firm can succeed.

Hence, in this paper we are going to show the importance of the TTO`s role and the university environment. Afterwards, we will point out the main features of the venture investors, particularly business angels and venture capitalists. Then, we discuss the proximity of these firms to science parks and incubators and their principal aspects. Finally, we will outline the government and legislation`s role in the formation of these kind of companies and their relationship in the industry field.

2.1.1. The role of the TTOs and the University environment

This paragraph outlines how universities facilitate the process of spin-off venture formation based on academic research. In particular, Rasmussen and Borch (2010) found out three main capabilities that the university environment might spread: (1) creating new paths of action, (2) balancing both academic and commercial interests, and (3) integrating new resources. The role of the university is especially crucial during the firsts stages of the new firm, where the university transforms itself into the most important stakeholder that affect the spin-off further reinforcement and growth. Accordingly, one of the central aspects of university's capabilities for developing academic spin-off firms is concerned with its ability to permit the starting-point of entrepreneurial activity. The latter has been defined by Zahra et al (2006) as the activity that is based on the identification and exploitation of opportunities. Some other studies revealed a positive relationship between the changes in the institutional framework at national and university level, e.g. changes in the IPR legislation and the creation of a TTO, and the number of spin-off formed, while the average performance of these firms reduces. The formation of a TTO is a strategical action from the university`s plan, but the creation of quality university spin-offs is a highly complex process that requires specific entrepreneurial abilities to sustain the firm facing the initial critical junctures. The success of spin-off companies seems to be related to personal characteristics rather than formal structures and policies features (Fini, Fu, Mathisen, Rasmussen, Wright, 2014). The capabilities that are required to the TTOs are those that can enable spin-off companies to be marketable and to attract investor and create a solid network. Sometimes, it happens that there is a discordance between universities´ aims to build quality spin-offs and the resources and abilities they have to reach this objective.

Several studies concentrate on university and TTO factors influencing spin-off and they divide four categories: research ability, university characteristics, TTO capacity and regional environment. The former is related to the significance of university research, due to the huge role of the quality and capacity of professors and graduate students to drive meaning research helps for university spin-offs. Some studies have evaluated the quality of university research looking at the academic performance, especially patents and publications (Jung and Kim, 2017). Another important point is the protection of intellectual property that has been examined by Lockett and Wright (2005) finding that the degree of patent effectiveness increases the probability of new firm formation. Another way to prove the importance of the university role is to appraise the number of publications and intellectual eminence that usually

rise the likelihood of university spin-offs (Di Gregorio and Shane, 2003). Moreover, the second group of University´s characteristics is related to the number of faculty and researchers, the size of budget or research fund, and organizational culture promoting commercialization (Jung and Kim, 2017). These factors positively affect the formation of spin-off companies. The more developed is the university in this field and entrepreneurial environment, the more it is likely to spinning-off new ventures.

Finally, we have to report some critical information about the importance of the TTO for the commercialization of technology. In particular, one incomparable characteristic of universities is that their different numbers of inventions is far greater than those of the private sector firm. As a consequence, the role of patents varies across industry and this outline the fact that the TTO must have disparate procedures, methods, and goals for every field (Kenney and Patton, 2009). Commonly, universities and their TTOs are usually centred on short-term profit maximization and acutely risk-averse in relation to financial and legal risks (Phan and Siegel, 2006). This factor can cause a reduction in the creation of spin-off companies and also it can affect the attractiveness of these companies for venture capitalists. The role of an efficient TTO is fundamental for the success of a spin-off firm as well as its speed in commercializing and sponsoring the new technology. As a consequence, universities should put more attention to recruitment, training and development of technology transfer officers with different based commercial skills.

Additionally, Bianchi and Piccalunga (2012) underlined that technological resources alone do not explain the performance of the TTO, but individuals with their own skills, attitudes and social relationships play a central role in bringing technology to the market. This role can be strengthened by implementing a series of human resource management practices that support and facilitate the work of individuals and the exercise of their activities.

Intellectual Property Policies are also a strong mean to support new ventures, they manage the individual cooperating organization’s arrangement that can make with each other with the aim of transferring or collaborating on intellectual property. IP may influence the relationship between the existing spin-off and research institutions, but also the quality of science and technology available at the research institute can play an important role. Until now, quality of the technology has mostly been studied by patents, but in the recent years there have been more investigations to measure the degree of technology development connected to spin-off companies (Shillo, 2009).

To sum up Rasmussen and Wright (2015) listed the principal characteristics of each institution and actor that participate in the creation of a spin-off firm.

Table 1: How different university levels can promote entrepreneurial competency development in spin-offs

University level	Opportunity development competency	Championing competency	Resource acquisition competency
Central university management	Indirect role: Prioritize scientific excellence and collaboration with users and industry	Indirect role: Have clear policies for how to handle commercial issues and professional support infrastructure internally at university	Indirect role: Make spin-off creation a priority for both internal resources and in relation to the university's external stakeholders
TTO	Indirect role: Provide arenas for active search for (alternative) applications of technology Provide access to diversified set of industry contacts	Indirect role: Add on external members to founding teams	Key role: Gain access to external funding and other resources to support spin-off ventures from public and private sources
Department	Indirect role: Make the search for commercial opportunities a part of the research activity	Key role: Make spin-off creation a viable activity for academics to engage in (e.g. promotion criteria). Make operational space for academics to pursue spin-off projects. Actively manage conflicts of interest. Create arenas to bring in team members with industry experience	Indirect role: Make available resources to the new venture such as academic sabbaticals, laboratory space, technician time and consumables Help the new venture obtain resources from external resource providers
Lab/research group	Key role: Involve external industry and investors early in the research process	Key role: Develop relationships with experienced entrepreneurs and industry people that can become champions for new spin-off ventures	Indirect role: Share networks with external resource holders
Individual researcher	Key role: Scientific excellence and industrial experience	Key role: Prior entrepreneurial experience and industrial experience	Key role: Network within industry and among investors
Student/ alumni	Indirect role: Use commercialization cases	Indirect role: Students and alumni can join founding teams of spin-offs	Indirect role: Alumni network to resource providers

Source: Rasmussen and Wright (2015).

1.2. The Venture Investors

One of the main impediment for the development of a spin-off firm is the capital´s rise, known as the *equity gap* or *funding gap*[4]. As we mentioned in the first chapter, spin-off companies present a very high level of uncertainty. Due to this risk, investors require more information to enable them to evaluate risks and bound suitable terms for funding. Moreover, these ventures need large sum of funds to transform an idea into a marketable product (Widding and Mathisen, 2009). Investors get involved in the process providing capital across university funds, university-related business angel networks, or semipublic seed capital funds. This environmental conditions' transformation is a consequence of the fact that growth-oriented spin-offs firms are progressively begin with technical entrepreneurs in charge of the start-up. These new ventures obtain managerial support from the financial investors, technical service providers, incubators, or venture accelerators with whom they operate or by whom they are supported (Clarysse and Moray, 2004).

In this section, we will analyze how spin-off companies attract venture investors to finance their projects and which are these subjects willing to invest in these fragile companies. In particular, we would like to outline what unique characteristics these companies have and how they affect their capital requirement, which are the resources available for them and which are the subjects that can help in this process, hence business angels and venture capitalists.

1.2.1. Venture Capitalists

The stage of financing is the most difficult and problematic for an academic spin-off company. In fact, university are used to finance the various costs concerned to IP´s protection due to their intellectual property policy, but they don´t support the company during the most challenging phase namely the financing of both technological and commercial development (e.g. prototypes and business plans). Meanwhile, there is a scarce number of investors willing to finance the project in the very first step because of the vulnerability and weakness of the high-technology market and the allegedly low entrepreneurial skills of researchers

[4] An *equity* or *funding gap* is defined as a situation where desirable companies don't get the volume of funding they need, due to market imperfections (Gualandri and Schiwizer, 2008, p. 102).

(Ndonzuau, Pirnay and Sourlemont, 2001). In a utopian case, venture capital financing provides the basis for the capital and managerial support requirements. Next, venture capitalists have a powerful role in advising the firms in which they invested, supporting them creating a network of contacts and decisions. What is the Venture Capital? "*Funds that are generally invested in the form of equity or quasi-equity which rarely affords any guarantee. Investments may take the form of simple shareholder's equity (common or preferred shares), as well as options, warrants, convertible debentures and other vehicles. The structure of the investment generally depends on the company's needs and its stage of development, taking into account the objectives of both the entrepreneur and the investor"(Réseau Capital*)[5].

The company itself benefits from the investment that enrich its credibility and renowned its ideas (Tykvová, 2004). Clarysse and Moray (2004) found that a progressive investment, across various capital rises, might be a better choice than a huge investment at the beginning. They found also that the participation of new external parties provides the firm the chance to reinvent itself. A Venutre Capital has been definied by Teker et al (2016) as a guidance to entrepreneurial skills and talents by supporting new ideas and basic science and convert them into marketable products and services that might hatred the world. The role of venture capital is fundamental to transform the simplest form of firm into mature organizations.

Another definition of Venture Capital is related to the risk investment in unquoted companies and the different financing steps concerned with the development´s phases of a venture-backed company (Sætre, Atkinson, Ellerås, 2004).

Normally, formal investors are represented by corporate and financial institutions and managed by professional venture managers. First of all, VC´s funds perform the foremost and profitable entities whose shareholders supposed to get a positive gain on their investment. The principal aim of venture investors is to find a firm with a potential for growth at the minimum risk of failure. In particular, they want to produce wealth for their investors, so they usually have also a smart exit strategy for their invested funds. One of the main relevant field of the formal venture capital industry is related to the corporate venturing or industrial investors. Specially, they offer support for start-up with innovative technology with the collaboration of more conventional venture capital management companies. They are used to furnish and nurture these new ventures with capital, market and technical help and these investments are often linked within the sector where they work. The advantage for the venture capital is that it can improve its knowledge to new developments and encouraging spin-off creation (Sætre, Atkinson, Ellerås, 2004).

[5] See also: http://www.iasp.ws/knowledge-bites

Another factor that influence financing support is the asymmetric information problem, above all in the first phases of the spin-off development that put relevant upfront search costs by future financial supporters. These subjects have to invest a lot of money also to scrutiny all the spin-off firm's aspects. Moreover, due diligence is a fundamental part of the venture capital support program directed to cut down the huge adverse selection problems deriving from asymmetric information between the entrepreneur and the investor. From the study research by Wright et al (2006), we report some important results. In particular, the study analyzed problems involved in attracting VC for university spin-off companies and their potential solutions from different point of views. First, TTOs and USOs (university spin-off companies) consider venture capital as very important in the first steps of the development. Secondly, the majority of VC investors surveyed preferred to invest in USOs after the first stage, known as "seed stage", because the proof of concept has been reached. They also identified that, at both seed and start-up phases, academic spin-off firm proposals had a major opportunity to get funds than a non-academic USO high-tech investments. This latter finding can be related to the abilities and skills of the TTO to screen and prepare high-tech spin-off proposals to obtain funding. Hence, we can conclude saying that VC´s funds are crucial in the different phases of USOs. To obtain them it is vital a strong collaboration between the members of the spin-off firm and the university transfer of technology office to develop the characteristics required to attract VC investors. In particular, there are a lot of database of EVC (European Venture Capitalists) in the internet where start-up and young entrepreneurs can look to find investments for their projects[6]. These databases can be a very useful source for USOs to find the capital requirements that they need during the development phase.

1.2.2. Business Angels

Compared to Europe, developing countries mostly from Middle-East, Asia and Africa are distant from European level in beginning new companies. However, few start-ups have the possibility to make a strong influence on jobs and growth and a slight number prosper from venture capital, with the ample majority reliant on informal founding (FFF)[7]. The field of start-up companies, in particular USO, is where the more interesting and appealing actions are

[6] See for examples: http://europeanventuremarket.mykajabi.com/ or https://www.investeurope.eu/ or http://www.eif.org/index.htm

[7] At the start-up stage, most entrepreneurial ventures are financed by the entrepreneur's personal savings known as founder, friends and family (Sætre, Atkinson, Ellerås, 2004).

being made by the business world through angel investing entering the sector with more than €7.5 billion invested annually in Europe. What are business angels? EBAN (the European trade association for Business Angels) defined them as:

"Business angel investors are high net worth individuals who usually provide smaller amounts of finance (€25,000 to €500,000) at an earlier stage than many venture capital funds are able to invest. They are increasingly investing alongside seed venture capital funds.

And also:

"Business Angel (BA) is a private individual, mostly high net worth, usually with business experience, who directly invests part of his or her personal assets in new and growing unquoted businesses. BA could invest individually or alternatively invest in syndicates where typically one angel in the syndicate takes a lead role. Besides capital, BAs provide business management experience, skills and contacts for the entrepreneur. Good BAs can provide "smart and patient capital"[8].

Business angels can be a promising source of financing for academic spin-off companies, in particular they act in the early stage of the process "seed" phase. This is one of the main differences from the VC investors, in fact the latter usually participate in the spin-off company during the last phases of development and consolidation. Business angels' attitude towards investments is different, they are used to invest in these project because of a personal interest and instinct and they rely less than VC investors in the due diligence. Besides, BA are more involved in day-to-day operations because they want to follow the project and coach the individuals from the beginning, sometimes they used to work part-time and there are cases where they also operate full-time to help entrepreneurs through challenging issues. VC investors are more interested in the returns (ROI) than BA and they don't get involved in operations. In conclusion, VCs are more objective in relation to financial return, less emotionally attached, and more interested in ROI (Sudek, 2007). These differences have been found also by S. and D. Teker (2016) and we can summarize them in the subsequent table:

[8] See also: http://www.eban.org/about-angel-investment/early-stage-investing-explained

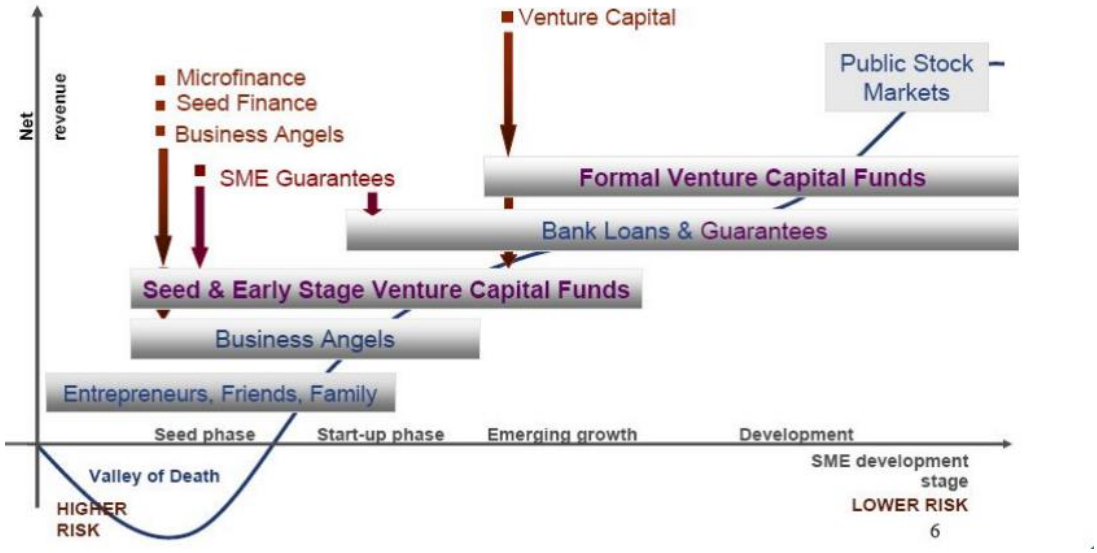
Table 2: Comparison between VC investors and BA.

Characteristics	**VC investors**	**Business Angels**
Origin of funds	Primarily institutional investors who act as limited partners invest others' money.	Private individuals that invest their own money.
Responsibility	Limited personal financial responsibility but responsibility to management and owners	Strong personal financial responsibility.
Experience and skills	Appreciable investment experience and capacity.	Narrow investment experience and capacity.
Due diligence's interest	Extensive time for due diligence.	Limited time for due diligence.
When they invest	Development and consolidation phases.	Seed phase.
Operational commitment	Some hours per month.	Part-time/full-time.
Exit Strategy	Fundamental.	Less important.
Holding period's length	3-5 years.	3-8 years.

Source: S. and D. Teker (2016)

In particular, we found a lot of studies about when BA and VC investors decide to participate in the academic spin-off companies and we can construct a graph about this process.

Figure 3: the spin-off financing process



Source: IBAN (2012)

1.3. Science park & Business incubators

Phan et al. (2005) stated that science parks and business incubators are institutions that intermediate as administrative centers with the aim of business acceleration across knowledge agglomeration and resource sharing. The raising importance of academic spin-off companies has led to an increasing curiosity towards these kinds of organizations and the benefits that may derive from their exploitation.

IASP (International association of Science Parks and Areas of Innovation) defined a science park as *"a space, physical or cybernetic, managed by a specialised professional team that provides value-added services, whose main aim is to increase the competitiveness of its region or territory of influence by stimulating a culture of quality and innovation among its associated businesses and knowledge-based institutions, organising the transfer of knowledge and technology from its sources to companies and to the market place, and by actively fostering the creation of new and sustainable innovation-based companies through incubation and spin-off processes".*[9]

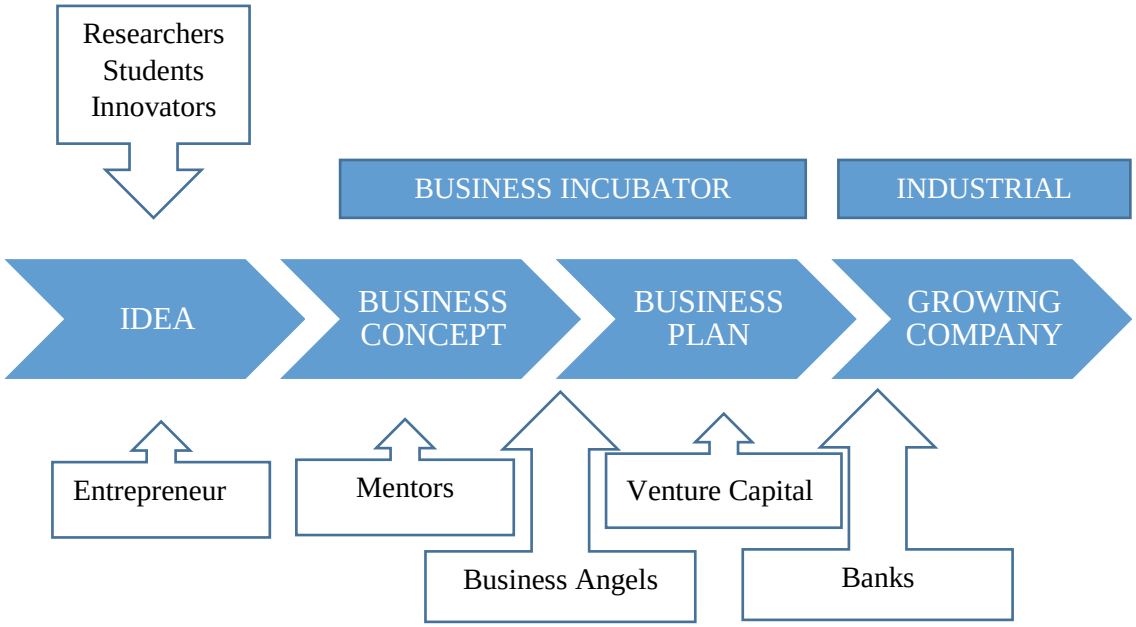
[9] See also: http://www.iasp.ws/knowledge-bites

Usually, a Science Park has two goals: the former is to help the regional economic development and the latter is to nurture new technology-based firms and knowledge transfer from universities to companies (Vilá and Pagés, 2008).

Normally, science parks and business incubators are defined as two different subjects within the technological entrepreneurial value chain that concerns a series of institutions linked through each other by the following changing of resource and knowledge inputs to marketable outputs during the formation of a new firm phase. Thus, these two entities represent the intermediate organizations that enable the social environment, technological and organizational resources, and managerial expertise for the shift of a technology-based business idea into a powerful economic organization. As a consequence, it is crucial to understand the role of these two subjects (Phan et al, 2005). There are a lot of studies about this argument, but there isn´t a common theory or definition about these two institutions because they're continuously developing new strategies and ways to commercialize technology. One of the most important study is that of Clarysse et al. (2004) which identify three different incubation strategies: Low Selective; Supportive and Incubator. We can distinguish the three approaches in relation to the goals and resources they need to reach. The first model's goal is to maximize the number of entrepreneurial firms with the same objective of the university to which the venture is connected. They usually are self-employment oriented start-ups that remain of standard size. Then, the Supportive model is viewed as another option to licensing out its knowledge and it produces profit-oriented-spin-outs, most of the time, with a promising future. The last model tries to deal with the choice between spinning-off a new firm in a new organization or using a body of research to generate contract research. It is also known as "exit-oriented" model due to the opportunity to obtain financial opportunity through the exit choice. In terms of resources, Clarysse et al, (2004) identify the Low Selective model as the one that requires the less amounts of persons and no organizational structure has to be formed independent from the university, while it still needs some facilities to support the new start-ups. Next, the Supportive strategy frequently has a very good IP department and contract research unit with at least 20 persons that work actively in the project. In this case, there is a major need of public/private partnerships, above all, in the seed or pre-seed phases. The last option, the Incubator model, is the longer process to spinning-out a new firm because every hypothesis is tested and it is financed by capital funds as shareholders at start. The evaluation of the ideas before spinning-out the company is very careful in this phase. Generally, the incubation process is described by NBIA (National Business Incubation Association) as *"a dynamic process of business enterprise development. Incubators nurture young firms, helping them to survive and grow during the start-up period*

when they are most vulnerable. Incubators provide hands-on management assistance, access to financing and orchestrated exposure to critical business or technical support services. They also offer entrepreneurial firms shared office services, access to equipment, flexible leases and expandable space all under one roof".

Figure 4: Example of Incubation as process



Source: Cases in European Entrepreneurship, Cooney (2011).

Thence, it is common that science parks entertain incubator programs attend to the development of new high-tech firms as academic spin-off ventures. Furthermore, researchers have found that business incubator can create a sustenance ambient for spin-off companies and accordingly, driving to farther development of growth-oriented firms (Chan and Lau, 2004).

Löfsten and Lindelöf (2002) outlined the principal characteristics that science parks have to contain in order to successfully help spin-off companies:

- The availability of business incubator companies in the environment;
- Active, profitable market near the area;
- A solid relationship between universities and the industry;
- Governments subsidies, incentives, contracts and research projects to innovation.

Science Parks and Incubators have been studied together because of their common features and the fact that they're often working together to encourage and nurture new high-tech firms.

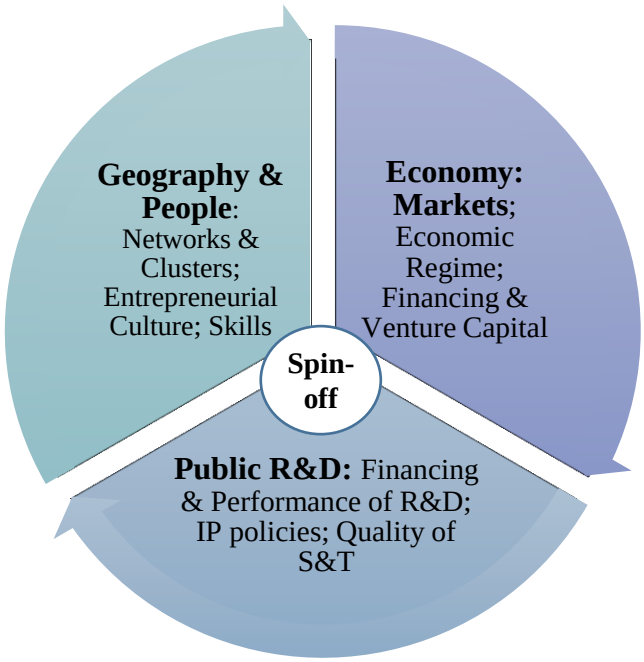
Besides, literature attempts to distinguish them, but it usually bundled the two concepts together as business support initiatives. It seems that BIs operate as tenant-feeders to SPs, helping and coaching new ventures during some important phase of their lifecycle (Ratinho and Henriques, 2010).

1.4. Governments, Industry and spin-off's environment

The interest of European policy-makers and managers of university campuses or public research organizations have been growing since the mid-1990s. This greater attention has been lead from US, where governments and institutions have been working hard to create measures, schemes, incentives to stimulate new venture's formation, above all improving TTOs facilities and strategies in the USO field. US ability to create and build strong relationships between universities and industries has been a model to copy for EU governments. The increase of academic spin-off firms during these years has to be related to the fact that ownership of intellectual property (IP) rights by TTOs, in relation to that of faculty, has rose due to the effects of the Bayh-Dole-like legislation which give the universities the possibility to own rights over their own IP. Moreover, another difference between US and EU was the "finance gap", namely the three "F" (friends, family and fools). In US, the finance gap was never strong as in Europe, companies easily found the capital they required in the seed phase. In Europe, the immobility of capital has convinced national governments to start a wide range of incentives to nurture and help high-tech start-ups and spin-offs companies (Mustar, Wright and Clarysse, 2008). These programmes can be divided into six groups, beginning from loan guarantee schemes to 100% public funds (Wright et al., 2007). So, new policies are needed to help the spin-off companies for the creation of and the consequent growth of the spin-off. Policymakers have also started to understand the important of enhancing skills in the TTOs (Siegel, Wright and Lockett, 2007), in particular there is the necessity to train, some industry associations and governments are already providing several special programmes, and also to recruit personnel with skills and experience of private sector start-ups and attract venture capital (Wright et al., 2006). Another important point could be a market segmentation identifying which universities and companies are more suitable to create relationship with the industry. Next, the nature of the links between the university and industry depends also on the degree of environment's development that can create barriers or advantages for the exploitation of resources, e.g. a university that is located in a developing

area has to invest in graduate programme that matches the characteristics of the industry where it is operating. Additionally, the integration level depends also on networks across public partners in a region like TTOs, regional development agencies, public research labs, and intermediary organizations. The development of different networks and links in the industry field may guide TTOs decisions about how to support an invention whether trough licence or joint venture with a private sector corporation or with the spinning-off process and venture capital backing (Siegel, Wright and Lockett, 2007). Governments and policymakers are paying more attention to this phenomenon also because USOs strengthen the economic development of the area where they're operating (Pattnaik and Pandey, 2014). We can state that governments look at universities as the leading edge of knowledge economy policy in all regions of the world. Academic entrepreneurship is not only a mean for knowledge-intensive economic development, but also by regions and cities within countries (Hepworth, 2009). In the first place, USOs help to create business opportunities by transforming an idea into a marketable product driving to market solutions. In the second place, they usually lead their activities locally (for example hiring, sourcing supplies and production) and so, this plumps the multiplier effect on local economic activity. Finally, they also may be the basis for the creation of geographic clusters of new ventures, above all in the high-tech sector (Pattnaik and Pandey, 2014). Schillo (2009) described the characteristics of a spin-off's environment dividing them into three groups: the overall "Economy" as the environment for any company's growth; the "Research and Development" sphere; the "Geography and People" that is not directly related with the economy, but it is crucial for the spin-off development. In this study, the public policy is not discussed as a different group because it is accepted that several public policies and programs influence every section and commit to the spin-offs' ambient within those groups.

Figure 5: Spin-off Growth Environment



Source: Academic Entrepreneurship, unternehmenrtum in der Forschung (2009)

The founding environment, like the kind of industry and the commitment of the government in the sector, plays a central part in embodying the resource opportunities of new firms. Waves of innovation trigger the creation of emergent markets. In some cases, they will growth and innovations, as price/performance improvements, arouse market revolution, large market size, and rapid market growth.

Thus, we can state that academic spin-off companies are crucial for the development of a region and the encouragement of innovation among young people. They create job opportunities and new stimulus for the economic environment in which they're operating. However, the USO by itself cannot succeed, it requires support and finance from several actors that intervein during the process. In these two chapters, we tried to summarize the principal information about this "new" phenomenon and which are the actors that can influence the different phase USOs have to face. To sum up, Rasmussen and Wright (2015) found specific features that the university spin-off company must have to succeed:

- Access to University's resources;
- Support from colleagues and research networks;
- A strong network with industry and investors;
- Infrastructure and finance from TTO;
- Resources and finance from external subjects (industry partners and customers);

- Team members with industry and entrepreneurial experience;
- Government grants and funding.

CHAPTER 3

THE CASE OF UNIVERSITY OF HOHENHEIM

2.1. Introduction

Germany offers about 400 higher education institutions which develop the entire range of academic disciplines. The German higher education attitude is towards a close link between learning, teaching and research. Germany is one of the world's most attractive research and higher education nations with about 340.000 international students attending one of the several German higher education institutions. A sixth of all doctoral degrees and an eleventh of all postdoctoral habilitation degrees offered by a German university are finished by international researchers. Besides, more than 40,000 international academics work at German higher education institutions and over than 18,000 international researchers attend German higher education institutions with support from German and EU funding programmes (Federal Ministry of Education and Research)[10]. In addition, we can point out that 3 of the most important German Universities are also on the world list of the first top 100 universities. They are University of Heidelberg, Technical University of Munich and University of Munich[11].

Figure 6: University`s situation in Germany

Source: Research in Germany's webpage

Hence, Germany's attitude towards research and development is positive and growing and it represents the ideal base to build new innovative academic spin-off companies.

In this chapter, we are going to report some data about spin-off environment in Germany, in particular in Baden-Württemberg. Afterwards, we will study the characteristics of University of Hohenheim, the problems and the advantages of this university in the creation and support processes for developing ideas and spinning out a company.

[10] See: https://www.research-in-germany.org/en/research-landscape/research-organisations/universities.html
[11] See: http://www.shanghairanking.com/ARWU2016.html

2.1.1. Germany´s academic spin-off situation

As we reported in the firsts chapters, policy-makers are very interested in the science-based start-ups and academic spin-off. Two factors that fascinate policy-makers are that these companies should be future-oriented and grow faster than a normal start-up, hence encouraging the economic structural change. In particular, they behave as an intermediary between the technology transfer process and the creation of appreciably several new jobs in future more than other kind of companies. Germany, with its contrasted and thickly research environment, owns an exceptionally favourable beginning for academic spin-offs, which is not yet been adequately studied (Hemer, Schleinkofer, Göthner, 2008).

Germany has a highly divergent system of qualification, thanks to its extensive assortment of institutional forms and funding opportunities. The system outlines the independence and differences among the doctoral and post-doctoral steps, each of them possess specific requirements on young scientists. In particular, every university has the duty to reward the most important scientific qualifications. The reward process, for young scientists, is supported by the Federal Government and the Länder, research institutions and funding organizations. Several structural improvements have been already reached with the funding of more solidly structured doctoral programmes (e.g. the Research Training Groups of the German Research Foundation DFG), the funding of graduate schools in the first funding line of the Excellence Initiative, the establishment of structured doctoral programmes with funding from the Pact for Research and Innovation as well as through the expansion of the additional qualifications offered (The Federal Government, 2014).

Entrepreneurship has been introduced in the academic curricula as a subject and business plan competitions were taught to create an entrepreneurial culture in universities. Nevertheless, some universities, in the beginning, doubted that these ventures could have a huge influence on economic growth and that top-down public-funding was the right instrument of supporting academic spin-offs (Ayoub et al., 2016). Before going on describing how academic spin-off companies have developed in Germany, it is important to give an overview of the entire higher education system.

In Germany, universities including other specialized institutions, offer the whole range of academic disciplines. Based on the German tradition, universities target especially on basic research so that advanced phase of study have mainly theoretical orientation and research-oriented components. Universities of applied sciences focus their study offers in engineering and other technical disciplines, business-related studies, social work, and design areas. The

usual aim of applied research and development concerns a noticeable application-oriented interest and professional feature of studies, which combine integrated and supervised work assignments in industry, enterprises or different relevant institutions. Almost a third of students attend universities of applied sciences.

The third major group refers to the colleges of art and colleges of music present studies for artistic careers in fine arts, performing arts and music; in these fields as directing, production, writing in theatre, film, and other media; and in a range of design areas, architecture, media and communication.

There are about 9.500 undergraduate programmes and approximately 6.800 postgraduate degree offers in the higher education system in Germany. The system is organized in a two-level academic qualification (bachelor and master's degree) and some subject fields that end-up with a state-certified exam (e.g. medicine). Then, there are some "Diplom" qualification from the old high-education program. There are private and public HEIs, but the major part of students is attending the public ones. Germany is a federal state, so the responsibility for education, especially universities, depends on the individual federal state's rules.

As a consequence, the actual structure and organisation of the different systems of higher education may change from state to state. In general, there is an official guideline that universities in Germany must follow to have similar requirements and to uniform their systems.

Germany has recently experienced a rising financial commitment to the area of higher education at a federal level both in terms of goal and importance.

Nevertheless, this commitment is limited by narrow constitutional rules. The German government can only legislate on issues concerning the access to higher education and academic qualifications[12]. Anyway, there are a few surveys about academic spin-off companies in Germany and for this reason is very difficult to have a general overview of the situation. Hemer, Schleinkofer, Göthner (2008) studied the differences between academic spin-off from the Eastern and Western Germany and the conditions of their success. These authors found that academic spin-offs rise both from universities and non-university scientific institutions and also from teaching hospitals, institutes related with universities (in Germany known as An-Institute) or from previous spin-off (the so-called secondary spin-off). Furthermore, they found some differences in the ways these companies look for finances and in the subsequent table they summarized them.

[12] See more at https://www.hrk.de/

Figure 7: Forms of financing utilized in the founding phase

Financing Form	West (n = 76)	East &Berlin (n = 31)
Founders' own capital	93 %	97 %
Promotional subsidies	33 %	52 %
Promotional loans	11 %	19 %
Bank loans	12 %	13 %
Other loans	5 %	19 %
Publicly promoted equity capital	9 %	16 %
Private venture capital	16 %	13 %
Turnover proceeds, cash flow	25 %	29 %
Other forms of financing	9 %	6 %

Source: Hemer, Schleinkofer, Göthner (2008)

In addition, they found that German young technology firms or science-based spin-offs bear, above all, to be manufacturers of capital goods or suppliers of system components or primary/intermediate products. In an outstanding report, the German Federal Ministry of Education and Research (2014) settled the value of spin-offs for ongoing economic and innovation policies: *"The Federal Government is aiming to amend Article 91b Basic Law in order to establish the constitutional framework for broader cooperation between the Federal Government and the Länder in the academic sector. The expansion of opportunities for cooperation provides the Federal Government and the Länder with a range of instruments which can be used to lastingly strengthen the performance of the higher education institutions at national and international level whilst at the same time upholding the clear division of responsibilities between the federal and Länder levels. The institutions of higher education form the nucleus of the science system with their unity of research and teaching. On the one hand, they train future scientists and on the other hand, they provide research results for the transfer of knowledge and technology. The focus will be on outstanding drivers of innovation such as the digital economy and society as well as on sustainable business/energy. Further planned priorities are new instruments for improved national and international networking activities involving science and industry, strengthening European cooperation through the skilful interlinkage of national and European research and innovation funding programmes (Horizon 2020) and improving governance structures (including regular quality assurance, control of results and impact analysis)".*[13]

Knie and Lengwiler (2008) took a partly historical approach by investigating the emergence of the spin-off issue since the 1960s in Germany. These authors were fascinated by the German case, because science and research policy in Germany is comparable to that in other

[13] See more at https://rio.jrc.ec.europa.eu/en/library/strategy-federal-government-european-research-area-era

relevant countries yet also distinct in critical respects. As the United States, France, Great Britain, and other tantamount states, Germany owns a deep, sophisticate, publicly funded science organization concerning of universities, other institutions of higher education, several backbones of research institutions beyond the university scheme and a lush culture of government contract research (Ressortforschung). Like the other successful countries since the 1960s, the German research system has been progressively pronounced by the rise of substantial science institutions and large research centres. In particular, Germany is a decentralized, multipolar structure where there is a split among the universities and the huge-science research centres farther the university design. The extra-university research organizations more famous are The Max Planck Society, The Fraunhofer Society, and the Arbeitsgemeinschaft der Großforschungseinrichtungen (the association of big-science centres, since 1970 called the Helmholtz Society) and they are about as big as the entire university system, but continue to stay independent of the academic sector. This scheme is very different from the Anglo-Saxon model which is more based on important research universities (Knie and Lengwiler, 2008).

As we have addressed before, the Federal Government is working to support and improve innovation. In doing so, it is offering some loans to students who have great ideas for helping them to found their companies.

For example, to allow innovative start-ups in Germany better access to venture capital, the Federal Government, via its funding programs "INVEST – Subsidy for Venture Capital" ("INVEST – Zuschuss für Wagniskapital"), awards investment subsidies to business angels who invest in start-ups and young companies. To enable the INVEST incentives to have their full effects, such subsidies are to be exempted from taxation.

The approach which is implemented in the "German Silicon Valley Accelerator" is being pushed to increase the interest of encouraging networking of German high-tech start-ups with global growth and value-creation centres. There is also a second Accelerator located in New York City, to intensify the presence of German High-Tech companies in the U.S. East Coast and its markets[14].

The "High-Tech Gründerfonds" ("high-tech-start-up fund") lends capital-intensive, newly established technology companies with initial capital and help them with know-how and networking. Thanks to the considerable number of contacts that connects the German venture capital market and the rest of the world, this program enable the market to transfer important amounts of money every year to finance new ideas. The collaboration with the industry sector is being reinforced by the acquisition of more private investors.

[14] See more at: http://germanaccelerator.com/

Moreover, every year a lot of events have been organized to sponsor innovative environment between industry and young entrepreneurs such as “YOUNG IT Start-up Summit” located in Hamburg. German Government is studying how to make easier for young entrepreneurs attracting funds from private investors, in particular there are some collaborations going on like with the Deutsche Börse Group exchange organisation, and additional market participants.

The programme “Gründungsoffensive Biotechnologie (GO-Bio)” (“campaign for biotechnology start-ups”), subsidizes start-up teams in the life sciences field during the pre-seed and seed phases. GO-Bio is targeted to the supports start-up teams in the life sciences in their pre-start-up and start-up phases, above all those companies with a high-risk.

The Federal Government is also spreading the entrepreneurial culture for start-ups via the “In novationsakademie Biotechnologie” (“Biotechnology Innovation Academy”), that is every year. Further, new ways to support these innovative companies (both start-ups and spin-off) are being studied such as the Life Science Incubator that is being brooded with a new headquarter in Lower Saxony. It is also important the “ESA Business Incubation Centres” that works to promote the transfer of space technologies into the industry field to commercialize these products and it follows companies from the start-phase till the entry in the market (The new High-Tech Strategy Innovations for Germany, 2014).

A research by Ayoub et al. (2016) investigated about one of these programmes, the so-called EXIST, and the fact that EBSG-firms (EXIST business start-up grant) produce less employment and have a worse financial performance than tantamount companies which did not get funding from the EXIST Business Start-Up Grant. This result doesn’t mean that Venture Capital funds are more profitable and successful, but that the role of the governmental programmes for financing spin-off companies has to be questioned.

Lautenschläger, Haase and Kratzer (2014) analysed 54 university technology transfer offices in Germany and they encountered several important results. They noticed that a high degree of heterogeneity in the accomplishment of university’s TTO employees, likewise the funding and support obtained from the EXIST programme, are decidedly admissible contingency factors for spin-off formation. However, there are still doubts in relation to the relevance of spin-offs as a powerful method to convert research results into economic value. These authors outlined that the university’s TTOs which believed in the spin-off formation like a transfer strategy were not more compelling in doing so. Thus, they concluded underlying the attention that universities, with the objective of promoting spin-off companies, should put in the patent policies and regulations to not endanger the management of research outcomes for entrepreneurial goals. Almost one third of the universities they interviewed did not have a

clear TTO's mission for underpinning spin-off companies. These results reflect the huge heterogeneity of this country and the need of further researches on this topic to discover new patterns and success cases to improve and develop academic spin-off opportunities and knowledge.

2.1.2. Baden-Württemberg spin-off environment

In this section, we will take into consideration the case of one of the most important university of Baden-Württemberg and Germany, University of Hohenheim (Stuttgart). Notwithstanding, before going on explaining the characteristics and the organization of this university, it is important to outline some figures and facts of this successful region of Germany.

Baden-Württemberg is the largest industrial location in Germany and one of the most important in Europe with about 1.5 million people work in the industry. Its share of 33% in gross value added is significantly higher than in the federal average (22%).

In industry, the capital goods sector, which includes the major sectors of mechanical engineering, vehicle construction and electrical engineering, is a priority. In these three sectors, 66% of total industrial turnover is generated and more than half of the produced capital goods are sold abroad.[15]

Baden-Württemberg has a valuable and variegated environment of university and non-university research and education institutions, integrated by a convoluted system of knowledge and technology transfer organizations. The higher education sector contains nine universities, 23 universities of applied sciences, six universities of education, eight colleges of arts and music, and the Baden-Württemberg Cooperative State University (DHBW) at nine locations that incorporate academic studies with workplace training. Moreover, Baden-Württemberg offers 27 non-public universities, and three academies for film, performing arts, as well as popular music and music business. Regarding non-university research, Baden-Württemberg comprehends more than 100 research facilities, for instance the European Molecular Biology

Laboratory (EMBL) or the German Cancer Research Centre DKMZ, as well as 12 facilities of the Max-Planck-Gesellschaft, 14 Fraunhofer institutes, and seven facilities of the Leibniz Association. In addition, the Heidelberg Academy of Sciences and Humanities, two

[15] See more at: http://wm.baden-wuerttemberg.de/de/wirtschaft/wirtschaftsstandort/wirtschaftsstruktur/

Helmholtz Centres, six institutes of the German Aeronautics and Space Research Centre DLR, 12 institutes of the Baden-Württemberg Innovation Alliance, the Centre for European Economic Research (ZEW), the Max Rubner Institute (Federal Research Institute of Nutrition and Food), and the Federal Waterways Engineering and Research Institute are located in Baden-Württemberg.

The research landscape includes further regional institutes such as the GermanFrench Institute in Ludwigsburg or the Max Reger Institute in Karlsruhe, among others (Regional Innovation Monitor Plus 2016). As a consequence, Baden-Württemberg represents a fertile ground for the creation of academic spin-off companies. We have also to mention that this region is the homeland of several famous companies like Mercedes, Porsche, Bosch and SAP and the fact that there are so many innovative and powerful companies can inspire the entire process of spinning out companies from universities. We have also to underline that Baden-Württemberg has a strong culture of successful technology and innovation policy. In particular, the trend of this increasing innovation is being stimulated by the entire Germany's system of policies and incentives. The new High-Tech Strategy from 2014 is aimed to move Germany ahead to becoming a worldwide innovation leader. The mentality of this country is based on looking to good ideas to be transformed fast into innovative products and services with the goal to lead the country to a higher level of prosperity and support of the quality of life. The sectors where Germany is investing are fields such as sustainable urban development, environmentally friendly energy, individualised medicine and the digital society.

Figure 8: core elements of the innovation strategy

Source: *"The new High-Tech Strategy"*, The Federal Government (2014)

In Baden-Württemberg, the on-going innovation strategy is focusing on upholding the state's exemplary situation concerning research, innovation and economic prosperity. The region is keeping to invest in attractive higher education and research environment with superlative university research, profile formation in scientific greatness, support for young scientists and entrepreneurial junior staff, strengthened science-industry networking, and ulterior expanding the regional growth areas (The Federal Government, 2014). From this innovation strategy, we can easily see how much importance the region and Germany give to the university and research system. One of the main objectives of this strategy is also to rise institutional funding of regional universities by bolstering the IT infrastructure at universities, helping access to information and targeted support of the research infrastructure, backing key technologies in the energy transition field, announcing new ways for education and qualification, suggestions for the positioning of engineering sciences, university and non-university research institutions[16]. The state of Baden-Württemberg is being involved deeply in creating new funding programmes or developing the past ones. These plans are working in terms of technology transfer support from the Ministry for Science, Research and the Arts and we can report two main aid systems: (1) "Young Innovators" encourages technology transfer over spin-offs from university and non-university research institutes; (2) "Industry-on-Campus" that helps to build strategic cooperation through universities and companies on university campus. Moreover, the government co-funds supra-regional policies like for example the Excellence Initiative which is managed by the German Federal and state governments (Regional innovation Monitor plus, 2016). This support program was initiated in 2005 and its aim was to transform Germany into a more charming research country by shaping it more internationally competitive and fixating debate on the distinguished accomplishments of German universities and the German scientific community. Especially, from 2006 to 2011 the DFG (Deutsche Forschungsgemeinschaft) got a sum of €1.9 billion in additional funding for the three funding objectives of the strategy: (1) Graduate schools to promote early career researchers; (2) Clusters of excellence to promote top-level research; (3) Institutional strategies to promote top-level university research. In June 2009, the initiative was accepted for other five years (from 2012 to 2017) with a funding of €2,7 billion[17]. Thanks to this program, universities established in Baden-Württemberg engage with a budget of €571m

[16] See more at: https://mwk.baden-wuerttemberg.de/de/service/presse/pressemitteilung/pid/hochschulfinanzierungsvertrag-perspektive-2020-unterzeichnet/ and http://cordis.europa.eu/baden-wuerttemberg/news-311_en.html

[17] See more at: http://www.dfg.de/en/research_funding/programmes/excellence_initiative/general_information/index.html and https://www.bmbf.de/de/die-exzellenzinitiative-staerkt-die-universitaere-spitzenforschung-1638.html

between 2012 and 2017, from which about one quarter is co-funded by the state of Baden-Württemberg (Ministerium für Wissenschaft, Forschung und Kunst Baden-Württemberg, 2014).

Another important pillar for this Land's strategy is powering Industry 4.0 and to become a leading location for it. There are some measures that the Land is launching such as Innovation vouchers and Innovation funding, which help the state to awards important regional innovation projects in small and medium companies from sectors like manufacturing, trade and technological service.

Others supporting measures related to fund of agencies pushing technologies (e.g. BIOPRO), regional clusters, the RegioWin competition as regional dialogue procedure for helping development processes in Baden-Württemberg's sub-regions, technology transfer managers, and funding for industry-related research (Regional Innovation Monitor Plus, 2016).

Additionally, the Baden-Württemberg Stiftung (Baden-Württemberg Foundation) funds projects in research, education and culture is crucial for supporting activities in the state. Its main goal is to protect the region's sustainability as an inviting district offering opportunities for the future. It was founded in 2000 with a capital of €2.3m as a non-profit organisation that funded projects with a total budget of €737m in 2014. This institution works as a state's research support and spotlight on application-oriented basic research in life sciences, photonics, miniaturisation, ICT, environment and energy, new processes and materials[18].

Another relevant character in the spreading of innovation through the state is the Baden-Württemberg State Bank, L-Bank. This Bank has the aim to reach the mission of supporting the regional economy, housing space, families, education and social projects. Among its projects, the L-Bank boosts economic development helping small and medium-sized companies and start-ups with a vast set of funding tools. The most famous programmes are (1) InnovFin70, made to guarantee scheme for SMEs in cooperation with the European Investment Fund (EIF), (2) Innovation funding for supporting R&D expenses in SMEs, (3) Start-up support. Besides, it is also working in cooperation with technology parks supporting them with infrastructures like laboratories or clean rooms by providing real estate and risk assumption for investments.

Likewise, Baden-Württemberg International (bw-i) is the state's competence centre for internationalising business, science and research. Its role is to support companies, universities and research organisations in their internationalisation activities, stimulate the contacts with the foreign markets and to increase the position of Baden-Württemberg on a global level. It is

[18] See more at: https://www.bwstiftung.de/die-stiftung/die-stiftung/

formed by a complete technology transfer system that collaborates with industrial organizations like Chambers of Trade and Commerce, Chambers of Trades, and business associations, industry-oriented research institutes, as well as technology centres and parks, and incubators (Regional Innovation Monitor Plus, 2016).

Thus, we can define Baden-Württemberg as one of the most innovative Land of Germany and of Europe and it provides the basis for academic spin-off formation and development. In this Land, we can find some of the best universities and research centres of Germany and Europe. Hence, the process of spinning off is only going to spread and increase more and more in the future.

Finally, it is problematic to find statistics about the number of academic spin-off companies created every year in Germany and specifically in the different Lander, due to the novelty of the phenomenon and the lack of surveys, literature and knowledge about it. Another trouble is that is very difficult to distinguish between different types of start-ups and spin-offs, so normally all the statistics or surveys just summarize the number of companies under the term start-up. The most recent survey about academic spin-off in Germany that we found was conducted by ZEW (Centre for European Economic Research in Mannheim) in 2004, which is a non-profit and independent institute for research.

Figure 9: Different types of business foundations and business start-up figures in the second half of the 1990s (average annual number of business foundations in Germany)

<table>
<tr><td colspan="6">Business foundations in all sectors

(255,800)</td></tr>
<tr><td colspan="4">Business foundations in research and knowledge-intensive sectors[1]

(64,400)</td><td colspan="2" rowspan="3">Business foundations in other sectors

(191,400)</td></tr>
<tr><td colspan="3">Academic new businesses
(37,700)

classified as...</td><td rowspan="3">Non-academic new businesses

(26,700)</td></tr>
<tr><td colspan="2">Spin-offs

(6,800)

Based on new knowledge / new technologies from public research. which are transferred through ...:</td><td colspan="2">Academic Start-ups

(30,900)

Knowledge/technology is a side-effect. For the business it is of...</td></tr>
<tr><td>Transfer spin-offs

(2,600)

... exploiting research results</td><td>Competence spin-offs

(4,200)

... exploiting competencies</td><td>Start-ups with transfer effects

(7,600)

... high importance</td><td>Start-ups without transfer effects

(23,300)

... low / no importance</td><td>With R&D activities

(4,700)</td><td>Without R&D activities

(22,000)</td></tr>
</table>

Source: *"Public Research Spin-offs in Germany",* ZEW (2004)

The table above collect the number and the types of companies created in the second half of the 1990s where we can see that academics were involved in about 38,000 firms' creation each year and on the other hand only 27,000 firms were formed without the participation of academics. In the second half of 1990s, about 6,800 academic spin-offs were formed in Germany each year and they accounted for 18% of all academic new businesses. Besides, the study analysed the differences between different kinds of academic start-up and spin-off, but there is the need for further researches about this trend, especially comparing the results in more recent years. In particular, we didn't find any statistics about academic spin-off companies of Baden-Württemberg, even if we asked to the responsible of this field at the Ministerium für Wissenschaft, Forschung und Kunst Baden-Württemberg, unfortunately he only had statistics and data about start-up companies.

2.2. Governmental programs

The burgeoning importance of the academic spin-off phenomenon and the subsequent need to translate research results, in particular new scientific findings as fast as possible into economic activities are attracting the attention of academia and politicians progressively towards what is concerned to the academic spin-off creation. These companies' formations from the higher education institutes and off-campus research infrastructures are a way to knowledge and technology transfer, which can establish that the research results collected by these facilities are transferred directly into marketable products or processes. Policymakers are investing more resources and time to create a positive and encouraging environment for the creation of these kind of companies. Several initiatives have been studied and promoted by the government and the Länder of Germany, some of them were discussed in the previous paragraph. In the following section, we will explain the two main programmes offered by the Federal Government of Germany and the Land Baden-Württemberg which are called (1) EXIST and (2) Young Innovators. We decided to outline only these two ways to support academic spin-off companies due to the fact that they are the most famous and important ones and the second programme is related only to the Land where University of Hohenheim is located. As we already mention in the last chapters, the main gap in the provision of spin-off finance is just after the seed capital stage creating what is known as the "Death Valley". In fact, while grant aid from public authorities is often available for proof of concept and related research activities, it is much more difficult to finance the next stage when commercial development starts but the company has not yet begun to generate sufficient revenue for its costs (Elpida, Galanakis, Bakouros, Platias, 2010).
Therefore, the support of financial and public institutions, as well as of customers and friends and relations, is very important for the growing of academic spin-off companies.

2.2.1. EXIST

EXIST is a support programme of the German Federal Ministry for Economic Affairs and Energy (BMWi). The plan's goal is to improve the entrepreneurial environment at universities and research institutes and increase the number and success of technology and knowledge based business start-ups.

The BMWi helps university graduates, scientists and also students to this way in constructing their technology and knowledge based start-ups. EXIST also encourages a lively and lasting entrepreneurial culture at public and private universities.

The EXIST programme concerns three schemes:

- EXIST Culture of Entrepreneurship supports universities in formulating and implementing a comprehensive and sustained university-wide strategy for increasing entrepreneurial culture and spirit.
- EXIST Business Start-up Grant supports students, graduates and scientists in preparing innovative technology and knowledge based start-up projects.
- EXIST Transfer of Research funds both the resource development necessary to prove the technical feasibility of start-up ideas based on research and the preparation necessary to launch a business.

EXIST is also co-financed by funds of the European Social Fund (ESF)[19].

The idea of creating this program started in 1997 from a speech of the US Council on Competitiveness: "…The greatest opportunity to strengthen the national system of innovation lies in improving the synergy between universities, research institutions and industry". During that period, the German Federal Ministry of Education, Science, Research and Technology (BMBF) was investigating on the problems in Germany such as the lower number of university graduates that were able to start the shift into their own activity or company; the fact that despite the excellent level of Germany's higher education system, there was a lack of a culture of entrepreneurship in teaching, research and university management. Moreover, even if there was an increasing number of new start-ups from the 1990s, this phenomenon was almost unexplored in the academic environment. These were the main reasons that made the BMBF thinking about a new way to encourage the entrepreneurship culture in the university's world and to make possible the transfer and commercialization of innovation and technology through knowledge-based spin-offs. The idea of EXIST started with the 1998 reform of the German Higher Education Framework Act, which included as a main objective the "transfer" part alongside with the work of teaching and researching. Afterwards, BMBF's commercialisation campaign was established and with the abolition of the "Hochschullehrerprivileg" (university lecturers' privilege), EXIST was finally launched.

[19] See more at: http://www.exist.de/EN/Programme/About-EXIST/EXIST-review/content.html

Figure 10: EXIST's logo

Source: Federal Ministry for Economic Affairs and Energy

EXIST's goals are:

- Build a culture of entrepreneurship in the academic field in the long-run.
- Transform the results of university research into economic values.
- Support and encourage new ideas for business and entrepreneurs at universities and research institutions in a targeted way.
- Rise the amount of innovative business start-ups and offer secure new jobs in the development.

The program was set up on the BioRegio competition[20] started in 1995. Thanks to the program, the regional infrastructure for companies in the biotechnology field was reinforced, a motivated and growing atmosphere was built. The BioRegio competition was transformed into a model for several subsequent policies.

The German funding system has no other funding programme like EXIST; it has the longest duration and currently follows some steps. It directly benefited start-up initiatives with a focus on universities rather than new start-ups.

When students or graduates have a great idea, they can transform it into a spin-off of success, but the problem is that there is a gap between the university and the company they want to create. They need money to fill this gap, because they also have to live, pay the rent and invest in their company even if it is not high tech. This programme helps individuals to fill this gap. It is directed to students, graduates and scientists that can apply for grounds.

"EXIST - Business Start-up Grants" and "EXIST - Transfer of Research" offer direct financial funding for building a new company by providing grants. This permits to those interested in initiating something, to set-up a business model, proof its economic growth,

[20] See more at: https://www.biodeutschland.org/en/home.html

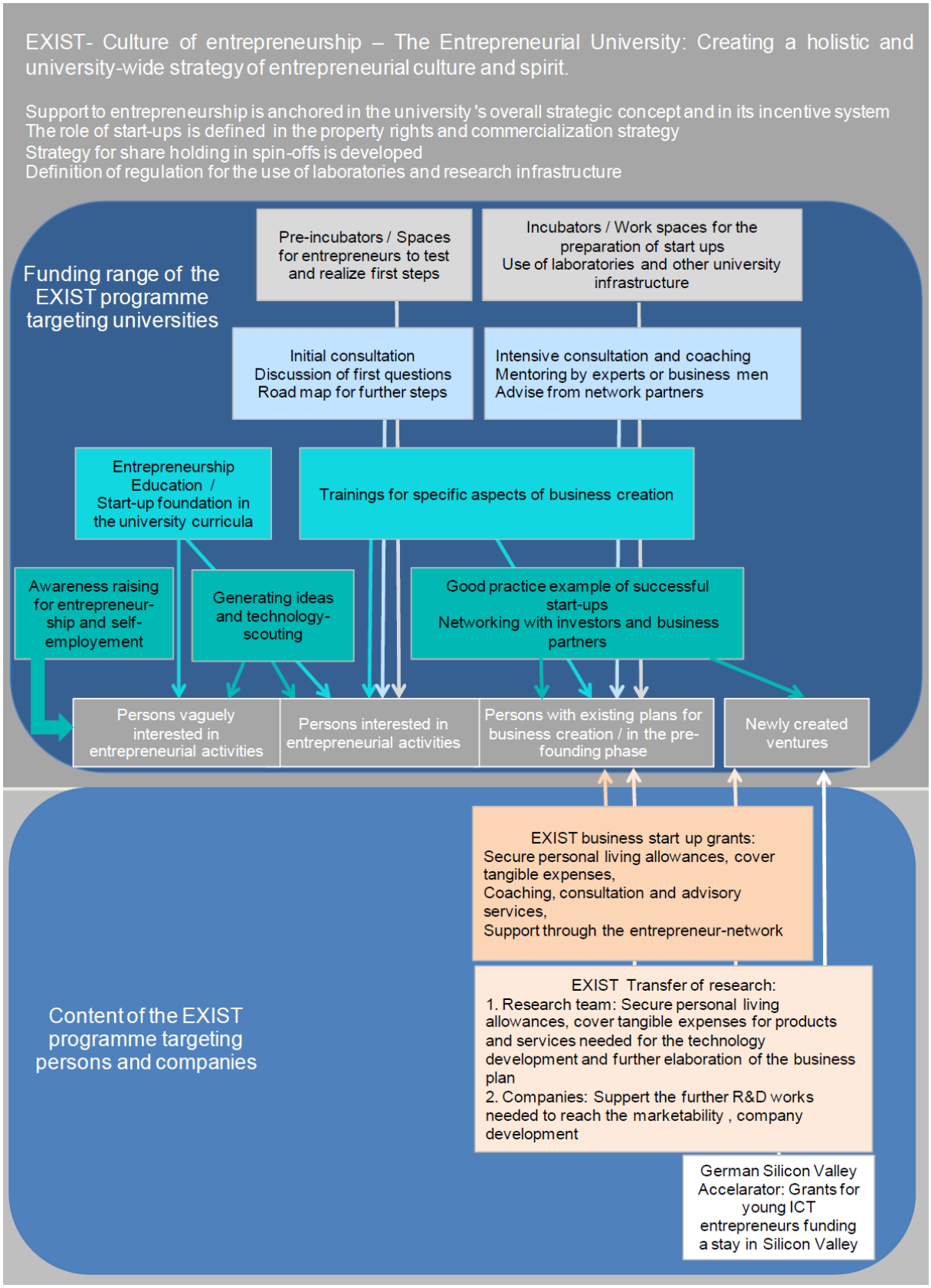
stabilize the financial resources and start with the first phases of developing a business. Additionally, it enables the team to check if they are working well and if they own skills and abilities to keep going with the process of spinning-off. The biggest advantage is that they can try to set-up a business almost with zero risk during the first year of funding, because it covers the personal living necessities.

The "EXIST Transfer of Research" option provides extensive development work for demanding start-up projects which can also be carried out in the parent organisation, making use of the resources available here in order to create the commercial basis for a new company. Financial support is provided, both for the preparation stages of the start-up and the first phase of developing the business after it has been formally founded.

The European Social Fund (ESF) has been co-financing the "EXIST-SEED" and "EXIST Business Start-up Grant" programmes since 2005, and the "EXIST Culture of Entrepreneurship" programme since 2007.

Further, it is important to mention also the EXIST-PrimeCUP, a business game competition which was initially conducted only in Baden-Württemberg and has been played all over Germany since 2007, thanks to additional EXIST funding until the end of 2012. This game is being played every year and it is organized in four phases: the campus cup (university level), the master cup (regional level), the professional cup (national level), and the champion's cup (final). Only the best groups can succeed to the next step of the process, but there are low entrance barriers which permit students to get to know if their skills are in line with the entrepreneurship in the competition. The aim of the competition is to increase awareness and comprehension through the different teams and to teach the required knowledge to start a company. Several universities around Germany compete in the game which was also brought to the other two German speaking countries (Austria and Switzerland) since 2013 (Kulicke, 2014). In the table below, we can see a summary of the main features of the three offers of EXIST analysed in a report from 2014 about the first 15 years of EXIST and its results.

Figure 11: Summary of the 3 EXIST's programs



Source: *"15 Years of EXIST "University-based start-up programmes"*, Kulicke (2014)

As we understand from the report, the first program is directed to universities to support them in the creation and fomentation of the entrepreneurship culture. Anyway, we are interested to outline the characteristics of the other two offers related to students support in their projects. Some surveys have been conducted about the effects of EXIST and its advantages or disadvantages and we have mentioned them in the previous paragraphs, but it is still a pretty new pattern and future research is required to test the consequences deeper. The results of the studies are mixed and inconclusive. At University of Hohenheim, it is being implemented a process of awareness about support programs such as EXIST to enable students and graduates to participate and find the help they need to start a business. This process consists in a series of Workshops about how to initiate a spin-off company and to explain what is an academic spin-off company.

During the first workshop organized by Ms. Ballesteros, they explained to us which programs and how to apply to receive grants to start a spin-off with support of the university. Principally, they showed us the two programs, EXIST and Young Innovatoren. In particular, we will start with the two options of EXIST: Exist grunderstipendium and Exist forschungstransfer. They differ in who can apply and what they are paying.

Exist grunderstipendium:

Who can apply must be a graduate, a scientist or a student. However, if it is a team composed by only students, it can't be founded. The government is offering its support through this program, but it wants students to finish their studies before applying. As a consequence, if it is a group built by one student and graduates, then it is supposed that the student will work part-time and he/she will have the time to finish his/her studies. Besides, it is not enough to form a team, there must be a mentor which is usually a professor from the university. If there isn't a mentor, the application is rejected (for both EXIST's options). The starting point to get the scholarship must be an innovative. knowledge based and completely new idea. Hence, it must be unique. Moreover, it is not sufficient to present this special idea, it has to be showed that it can have success in the future. EXIST Business Start-up Grant is a real scholarship, but the people who apply for it are not employed at the university. They get money in relation to their status, e.g. they can receive additional money if they have families. Normally, it is possible to apply for one year, but there is a possibility for prolongation (EXIST's members are very skeptics to allow it). The grant contains also an amount of money that is aimed to buy materials. If it is a team that is applying, there is the chance to ask for extra material and also for coaching. If the participant buys new material, it belongs to the university.

Nevertheless, if the subject initiates a company and leaves the university, then the latter must If the team wants to leave the university, the latter must give back the materials to the individuals at friendly conditions due to the fact that it shouldn't earn money.

The application works starting from a form that the participant must fill with several information, such as the personal data of the entrepreneurs (who they are, what kind of academic education they have…). It must be written a letter of motivation with the application. Hence, the individual or the team must describe his/their idea in a very convincing way, not in an academic speech, because people that read the applications don't understand that kind of writing. Afterwards, it must be sign the commitment which the people that are applying are really interested to work on their projects and not anything else, e.g. illegal activities.

The subsequent step is to send the application to the project-trainer. The application must be signed also by the university and there is no deadline, participants can apply at any time they want. Still, they need to keep into account that their request will require three months for evaluation. Therefore, they should apply very early and not in the period where they're running out of money. The location where they are working doesn't matter, the pre-requisite they must have absolutely is a mentor that follow them and the fact that they are not working for other companies.

Details of the scholarship of 1 year:

- Entrepreneurs with a doctorate: 3,000 €/month
- Graduates with a university degree: 2,500 €/month
- Students: 1,000 €/month
- Child benefit: 150 €/month per child
- Additional Materials and equipment: 10,000 - 30,000 €
- Coaching: 5,000 €

Exist Forschungstransfer:

This option is very similar to the previous one, but it differs in some details. The founder must be a person with an academic grade (usually, scientists, not students) and it also needs a mentor (like before, usually a professor). The project has to concern innovative technologies, but it must be developed further and have higher risks. The economic prospect should be much more. When a person apply, it is very difficult to convince the jury that the project is authentic innovation. There are two phases for the scholarship: (1) 18 months (optional 36 months and usually they allow the prolongation), where the participant should bring a proof

of concept, he/she can develop a prototype, a kind of prospect for the future that shows the real possibilities in the market and the business plan to fund the company. Then, only after, the participant can pass through step (2). In this second stage, the applicant is really working in the business and he/she has to find extra investors and this is crucial. In particular, during this phase, the company is founded, business operations start, the company enters the market and tries to get external business financing. Normally, the team for EXIST's transfer of research is composed by scientists and persons with managerial competence that can be found in the university or in external subjects such as a Business Angel.

Funds depend on the status of the person. The individual/team can apply up to 250.000 € also for materials or money for coaching and for employing students. Then, they have to show that their project can be realize and at the end they found the company (1).

During phase 2, they can apply for 180.000 €, max 75% of the project in total. They have to find an investor who invest up to 60.000€ (Equity Capital ratio 1:3). If they don't have an investor, they will not get the 180.000€.

The application for phase (1) is communicated by the department of research and development, interested people can apply in 2 months of the year, when this jury is evaluating the applications. So, if they send it on August, they have to wait till January. Afterwards, the team is invited for the presentation in Berlin. The 1° evaluation is done by the project-trainer, then by experts. They will have a look also as you as a person. CEO and team have to do a very good impression.

The first part of the application is very easy, individuals have to attach in the application a short description of their project, the plan for the next 18 months and a relation of your mentor. If they are invited to Berlin, they go through the next step with the presentation of the project. After that, if the individuals have been selected, they have to fill a complete application.

2.2.2. Young Innovators

The Young Innovators program helps young scientific staff from universities and non-university research institutes to become independent in the production and sale of innovative products or processes. Only companies founded on products and processes based on inventions of business founders, a software developed by them or their technological know-how, are eligible for funding.

The aim of the program is to create an alternative to dependent employment while at the same time encouraging the transfer of technology and know-how from universities to industry. Future-oriented fields such as optoelectronics, biotechnology, medical technology, solar technology, automation technology and mechatronics are the main focus.

The funding consists of four building blocks:

- Compensation of the founder or the founder for a maximum of two years (in special cases three years) in the amount of 50% of a position in the TV-L level 13.
- Material and investment expenditure subsidies up to a total of EUR 20,000 (the acquired objects belong to the property of the university or research institution).
- Possibility to use the resources of the university or the non-university research institution.
- Continuing vocational training through group or individual coaching up to the amount of 5,500 euros per business start-up.

The target group of the Young Innovators program is young scientific staff and graduates who have not interrupted or completed their studies at the university for not more than 18 months before the closing date for the grant applications. The Ministry of Science will announce the end of the deadline within the framework of the relevant invitation to tender. The target group also includes former scholarship holders and scholarship holders of the support program EXIST. Without prejudice to an "overlapping" period of up to 3 months at the beginning of the grant, concurrent action on budgetary positions or in third party projects is excluded. Candidates who are promising can be promoted at the earliest from their dissertation.

In special cases, it is possible to promote applicants who have not been employed as research assistants at a university or non-university research institution if they can prove that they have completed their studies or work at the university or research institution High school.

It is not the start-up as such, but the targeted preparation in the care of the university or non-university research institution in Baden-Württemberg. The founders receive support to secure their livelihood and an accompanying coaching by people with special needs. In addition, they can use the university's infrastructures.

Baden-Württemberg is known for high-quality products and services. As a technology base, it has an above-average number of highly qualified workplaces. The implementation of innovations into high-quality, marketable products and processes is of particular importance, it is still necessary to maintain this position. They are, in particular, young scientists who, with their creativity, stimulate innovation. It is therefore an explicit concern of the country to encourage scientific employees to include the option of setting up a company in their career plans.

The "Young Innovators" program offers an incentive to take the leap into self-employment. The program is a successful tool to support business start-ups from universities and non-university research institutions in the country. As a result, Baden-Wuerttemberg took over the pioneering role for the personal promotion of business start-ups from the scientific field. The funds are well invested, as most companies have their location in Baden-Württemberg. From 1995 when the project was started, more than 200 projects have received young innovator funding[21] (Ministerium für Wissenschaft Forschung und Kunst Baden-Württemberg).

The activity as a scientific employee or academic staff or graduate studies must not be longer than twelve months, in exceptional cases 18 months. For start-ups and entrepreneurs with an academic degree within a start-up project, which receives an upstream federal funding (e.g. EXIST start-up scholarship), no parallel funding may be given. A promotion in the JI program of the Ministry of Science can only take place after the conclusion of the EXIST federal funding. In the case of business founders who have received a federal promotion, the latter must not be longer than twelve months and corresponding proof must be provided.

It is not the foundation of the enterprise as such, but the specific preparation in the care of the university, the research institution or the academy.

During the period of time, which is usually between the innovation and its marketing due to the necessary development work up to market maturity, the livelihood for the subsidized business start-ups can be secured by a two-year (in exceptional cases three) of funding (Foerderdatenbank).

The Karlsruhe Institute of Technology (KIT) is the project sponsor of the "Young Innovators" program (Ministerium für Wissenschaft, Forschung und Kunst).

Figure 12: Junge Innovatoren's Logo

Source: Ministerium für Wissenschaft forschung und Kunst Baden-Württemberg

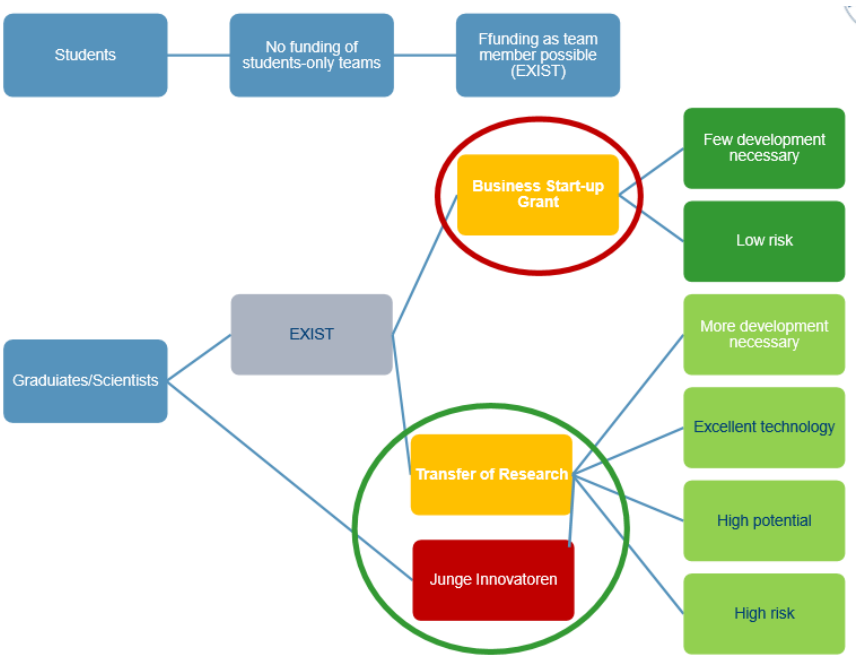
[21] See all the projects here: https://www.google.it/search?q=traduttore&rlz=1C1CHBF_itDE740DE740&oq=trad&aqs=chrome.0.69i59j69i65j69i57j69i61j69i60j69i61.3129j0j7&sourceid=chrome&ie=UTF-8

As we mentioned in the previous paragraph, more details about this program were outlined during the first workshop, about academic spin-off, by Ms. Ballesteros.

JUNGE innovatoren is a program that usually people consider after the termination of the EXIST scholarship. The project presented in the application should be innovative and based on knowledge, it can be a product or a technique or a service. Applicants should show the possibilities to enter the market and that, after EXIST, they still need money and time to develop it. This program lasts two years and like EXIST, applicants can ask money for equipment (they will belong to the university), or additional money for other costs. The application is sent from the university, usually during the summer and there are two steps: (1) there are two juries, the first will select the best applications, then there will be an extra jury which advice who should be founded. (2) transfer of information about the entrepreneurs, plan's costs, declarations from mentor, university and start-up network, verification of counselling interview.

How to select the right programme from the point of view of the applicants?

Figure 13: how to select



Source: Spin-off Workshop's slides by Ms. Ballesteros (university of Hohenheim)

For example, students can't be founded, but in the case of EXIST, they can apply when they are a part of a Team. Moreover, there are some advantage and disadvantages of both programs.

In the case of Grundestipendium, we can consider it as a scholarship, as a consequence, in Germany, people still need to pay their health insurance and there is no employer that would

pay half of the cost. However, it is only for one year, so it is not a long period of time. On the other hand, when the applicants win Forschungstransfer or Young Innovatoren, they are employed at the university, so they will have several benefits (e.g. if they need more time, university will help them). Nevertheless, it is not easy to be accepted, the idea must be unique. Several applications are rejected every year. Ms. Ballesteros has some experience with these programmes and she also gave some tips during the workshop regarding the application which has to be convincing. Applicants should ask themselves these questions before participate to the program: *What is this product? What is this service? What does it do? Who can need it? Who would be the costumers? Who is going to pay for this product? Which is the market?* If the project is rejected, the applicant can try to improve its idea and apply again, the only limit is that you can apply until 2/3 years from the graduation.

2.3. University of Hohenheim

Figure 14: Hohenheim's Palace

Source: own Picture

The origins of the University of Hohenheim date back to the year 1818, but the Palace was constructed in the 18th century. The first documented reference to Hohenheim was in 1100.
King Wilhelm I of Württemberg built an Agricultural Academy for teaching and experiments in Hohenheim in 1818. The starting point of this university was very moderate, in addition to the first Director Johann Nepomuk Hubert Schwerz (1759-1844), who was accountable for all agricultural disciplines, two other professors were operated: one for Mathematics and Physics, the other for Chemistry, Mineralogy and Botany. Certainly, at that time there were only 16

students who required education. In 1964, two faculties - a natural science and an agricultural science faculty - were established. Especially, in the area of natural sciences, various new departments therefore had to be formed. From the end of the war until 1964, the number of departments more than doubled. In 1968, the third faculty was initiated: The Faculty of Business, Economics and Social Sciences developed out of the applied business and economic sciences in the Faculty of Agricultural Sciences. Nowadays, almost 10,000 students are attending at the University of Hohenheim. Corresponding to the jump in the number of students after World War II, the number of professors and employees at the University also grew quickly: In 1990, there were almost eight times as many professors as in 1946. Today, the scientific personnel numbers 940 people, 123 of whom are professors. The total number of people employed by the University is 2,040. In the 20th century, the University has had its biggest enlargement to date. Since then, the merging of agricultural sciences and natural, economic, and social sciences has created a unique profile[22].

The University of Hohenheim is a diversified, intricate, and active institution. Its members work together in academic self-administration. The accepted basis is the legal mandate, and the necessary values are established in the structural and development plan, which outline the prevalent strategic development objectives in five-year periods.

The mission's statement of University of Hohenheim is represented by the three biggest areas of the institution: research, studying and teaching and the activities of support for these areas. Moreover, academic self-administration drives individual members to be dynamic not only in one single field. The University established this mission statement in 2015 while implementing a quality management system in all of its major areas. The mission statement is the beginning from which the single areas determine their specific objectives and standards for quality advancement and also the kind of behaviour that is prosecuted.

"Humankind's basic curiosity is the driving force of research. We carry out research in order to gain new scientific knowledge. Led by this scientific curiosity, we search for solutions to as yet unanswered questions with which we can make a contribution to resolving important issues" University's statement.

Here below, we will report some facts and figures about Hohenheim University to give a general idea of the characteristics of this huge academic environment.

[22] See more at: https://www.uni-hohenheim.de/en/history

Figure 15: Facts and Figures Hohenheim University

Staff (2015) Headcount, 1 Jan 2016

Total number of staff	**2,041**
Total number of academic staff	**941**
Professors	123
Academic staff	818
Non-academic staff	**1,100**
Ratio of students to teaching staff	10.4

Accounts (2015)

Finance income (2015, in EUR million)	
State funding	98.1
Third-party funding	31.2
Expansion program	13.1
Additional state funds	1.7
Total	**144.2**

Area (2015)

Total area of the University of Hohenheim	**838 ha**
Area of the campus	355 ha
Off-campus experimental stations	483 ha
Total building area (main area)	**173,035 m²**

Energy (2015)

Water consumption	141,520 m³
Heat consumption	50,405 MWh
Electricity consumption	18,579.1 MWh

Degree programs (winter semester 2015/2016)

Degree programs	**48**
Bachelor's degree	11
Master's degree | Double degree Master's	25
Diploma (discontinued)	6
State examination (discontinued) and teaching qualification	3
Doctorate	3

Students (winter semester 2015/2016)

Total number of students	**9,759**
Female	5,548
Male	4,211
International students	1,351

Students based on faculties

New Students (academic year 2015/2016)

Total number of new students	**2,902**
Female	1,623
Male	1,279
Internationals	349

Student mobility (2015)

	Incomings	Outgoings
Faculty of Agricultural Sciences	64	78
Faculty of Business, Economics and Social Sciences	14	50
Faculty of Natural Sciences	67	151

Development of the student figures

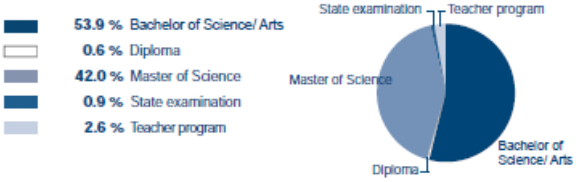
Growth in student numbers over the last 5 years	
2011/2012 winter semester	9,220
2012/2013 winter semester	9,628
2013/2014 winter semester	9,918
2014/2015 winter semester	9,853
2015/2016 winter semester	9,759

The student numbers rose by 5.8 percent between 2011/2012 and 2015/2016.

Graduates (academic year 2014/2015)

Total number of graduates	**2,297**
Female	1,314
Male	983
Internationals	236

Graduates based on degree type	
Bachelor of Science/ Arts	1,239
Master of Science | Double degree Master's	964
Diploma	14
State examination	21
Teacher program	59



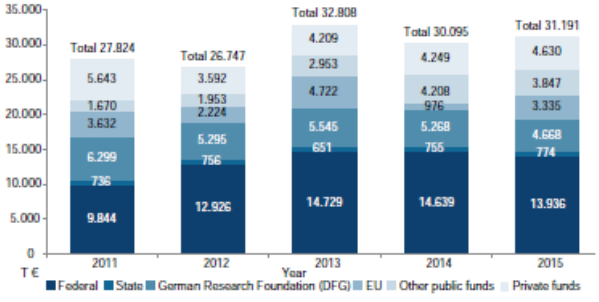
Doctorates/Habilitations

Doctoral candidates (academic year 2014/2015)	**148**
Female	67
Male	81
Internationals	34
Habilitation candidates	**3**
Female	1
Male	2

Third-party funding (as of 31 Dec 2015)

Total third-party funding (2015)	**31,191**
Faculty of Agricultural Sciences	10,748
Faculty of Natural Sciences	4,941
Faculty of Business, Economics and Social Sciences	3,034

Third-party-funding in last 5 years according to source



Source: Hohenheim University

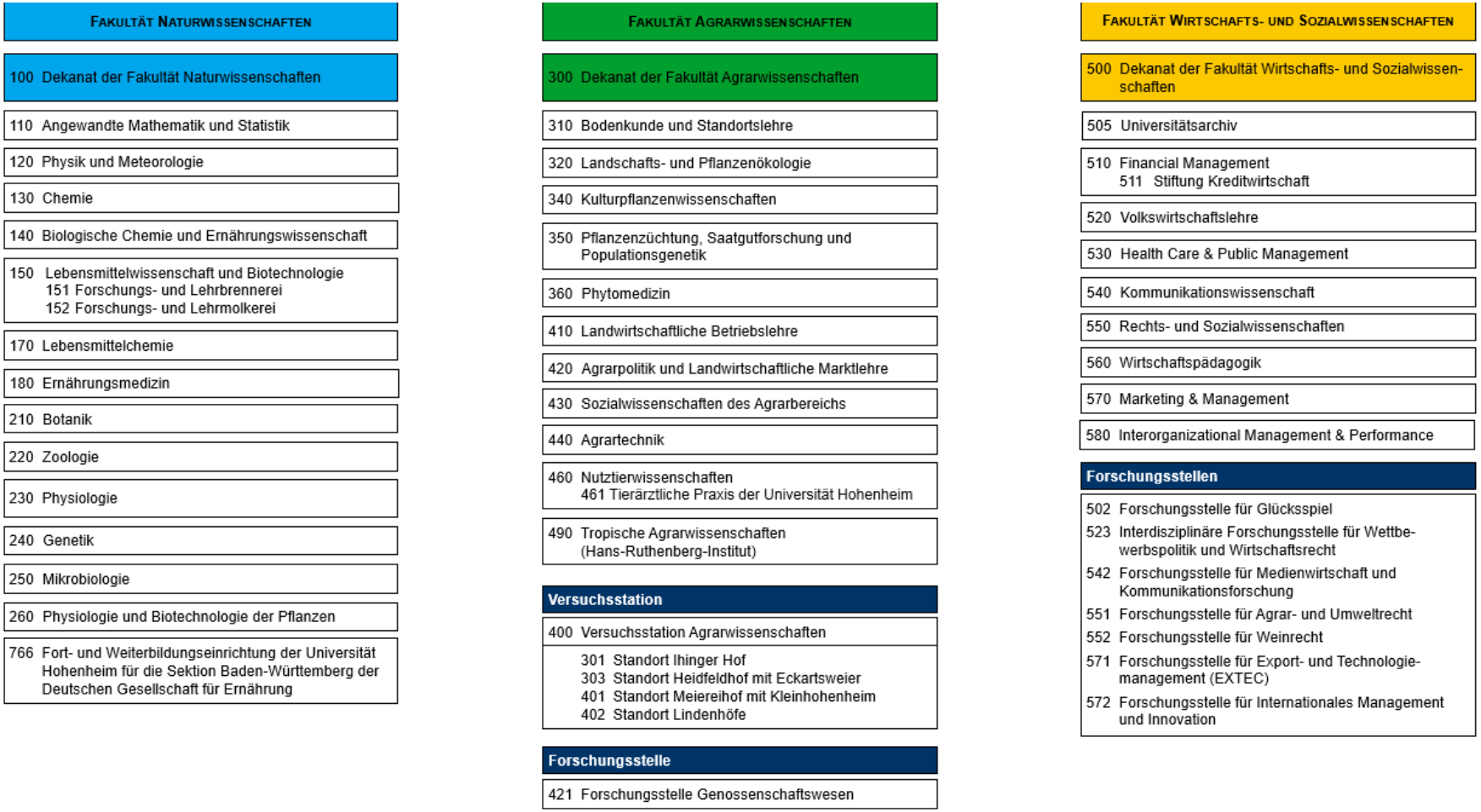
2.3.1. Organization and TTO

Until April 2017, at University of Hohenheim there wasn't a real plan or established support organization such as a TTO (Technology Transfer Office) to help who had a good idea to implement. During the last few months, the university hired more people in the entrepreneurship department trying to form and build a real TTO and to spread the entrepreneurship culture through the different areas of the institution.

Before April 2017, the people that were helping students or graduates going through the creation of a business were the two responsible of the IP legal department: Janina Glindemann and Johanna Ruths. However, if a student needed help with some other issues, there was almost no one at Hohenheim with a clear knowledge of the entire spin-off process. Usually, who was interested in starting a business had the help of a professor interested in the subject or product, but there wasn't any official procedure to follow or specific person to go for asking advices and support. It was a very confused situation and we didn't find any materials about the different people or procedures that took part in the creation of the firsts academic spin-off companies of University of Hohenheim. The previous workers in the technology transfer department were not organized. We tried to draw a general situation during these last years, but it was impossible due to the lack of information.

This organigramme below represents the organization of the faculties at University of Hohenheim.

Figure 16: Hohenheim's Faculty



Source: Hohenheim's webpage

Today, the people that are working in the department of support academic spin-off companies are: the two women from the IP office; professor Kuckertz (head of the Entrepreneurship Institution), Ms. Ballesteros (responsible for the support activities) and a TTO manager that we didn't had the opportunity to interview because he was hired at the end of July 2017. To give a general impression of the confused situation and the lack of information, we will report what Ms. Ballesteros told us about the present situation.

"At the moment, it is really complicated, because we are in a progress of setting up all these things and we don't have any experience in this University. We have experience in other universities/organizations, but not here and that's a problem. Also, the future TTO manager has experience in his university, but he will renew in July, he knows the process and so on, but not the people and the process in here" Ms. Ballesteros said.

When we tried to ask information about the previous procedure or what was done until April 2007, we didn't get much. The people, working in the department now, said that if someone (student, graduates, phd students) was interested in asking for support to start a business, they had to come to this department and ask for example: "I want to protect my idea, how can I do that?". However, these were the only information that we found about the "past".

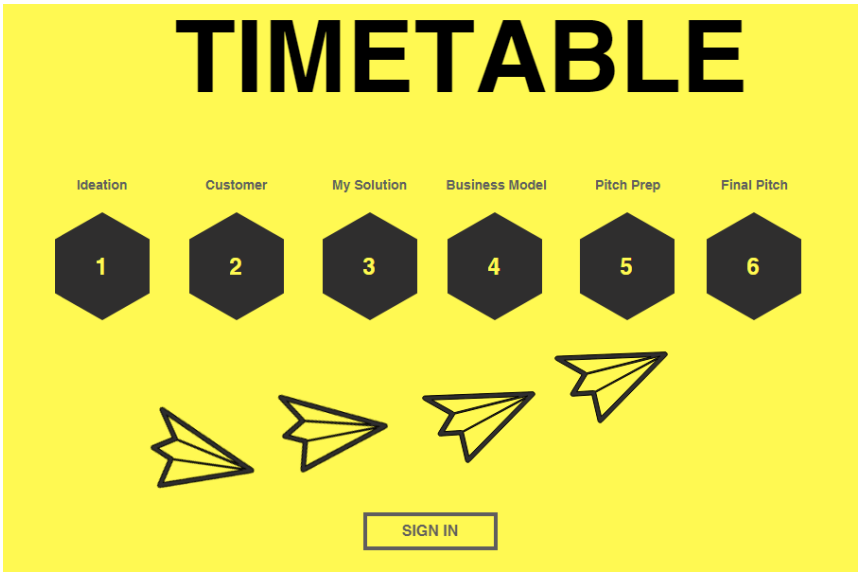
Despite the lack of information about the organization of University of Hohenheim, we collected enough materials about the process which they want to implement now and their mission for the future. In particular, thanks also to Professor Kuckertz, the entrepreneurship culture is being spread in a deep way through the university and there are a lot of initiatives that have been implemented or will be offered. The view of Professor Kuckertz is very clear and we report this phrase that represents it: *"We don't select ideas. We support everyone who wants to change the world with their business - we would be crazy to limit entrepreneurial activity".*

Among the activities that have been organized, we will mention the most important ones such as the Start-up Garage or the several seminaries with relevant entrepreneurs from big companies who explain during the semester their business cases to the students, trying to inspire and teach them how to behave in the real job-market.

The Start-up Garage is crucial to spread knowledge and entrepreneurship abilities across the students who are interested in it. Every student attending Hohenheim can take part at Start-up garage. Their value-proposition is to believe in the power of interdisciplinary and they are thus looking forward for participants from agriculture, natural and economic science, the three

faculty at Hohenheim University[23]. Students can participate also if they don't have a business idea. In fact, they can either present their own idea and find team members to test and realize it or they just join a group within the first session. Start-up Garage is every year, the next one start in October 2017. To apply to the program, students must subscribe to the Newsletter on the homepage of Start-up Garage and click "Yes" for real when it is asked about their interest in participation. There is a maximum number of students who can apply for the program and if the number is reached, students are registered in a waiting list for the current or the next session. During the year, at Start-up Garage, students operate cooperating with fellow students on a real challenge and they have the possibility to experience the real problems and benefits of being an entrepreneur.

Figure 17: Start-Up Garage Process



Source: Start-up Garage's webpage

They basically meet every two weeks to follow an established process from ideation to pitch preparation. Besides, during the semester, they organize meeting on business cases and some activities to get in touch with other interested students or to bundle and spread the entrepreneurship culture such as the Start-Up barbecue.

[23] See more at: https://www.garage-hohenheim.space/

Figure 18: The last Start-up Barbecue invitation

Source: Leif Brändle (Facilitator Startup Garage Wissenschaftlicher Mitarbeiter)

Another important source of inspiration and information is the webpage of University of Hohenheim, especially the part of "Start-Up-Porträts" where the university is starting to collect interviews about successful business cases from people who are studying or studied at Hohenheim and have created a company[24].

Finally, another institution is Startup Hohenheim which is an independent and not-for-profit student initiative. These students have set the goal of promoting the founding culture in Hohenheim. Apart from the theory in the lecture hall, they would like to offer other students the opportunity to get an access to the company foundation. To this end, they aim to organize a wide range of events in the framework of founder tribes, to present impulses on the topics of the founding of the company / self-employment and excursions to start-ups of the region in order to get to know the topic of company foundations from different perspectives.

[24] See more at: https://entrepreneurship.uni-hohenheim.de/start-up-portraets

Figure 19: Some Spin-off and Start-ups of University of Hohenheim

Source: Start-up Hohenheim webpage

2.3.2. IP department strategy

The IP department mission is the promotion of knowledge and technology transfer which belongs to the legally anchored core tasks of the universities. With their unique scientific profile and its future-oriented research in the fields of Bio-economy and Sustainability, Global Nutrition, climate change and ecosystems, Food, nutrition and health, the University of Hohenheim is responsible towards society, economy and politics. It is, therefore, the science generated in the university findings and results optimal for society and business to make use of, protect and recycle. The university also benefits from the interaction and the reciprocal exchange of ideas, knowledge and technologies with partners from business and society. The aim of this strategy is the presentation of transparent principles for the dealing with the generated knowledge at the university. There should be clear principles and procedures for use and exploitation of intellectual property of the university, in which women scientists (and their cooperation partners in economy and society), can orient themselves to their important task in the field of knowledge and technology. All of them developed, at the University of Hohenheim, research results intellectual property. The focus of the present strategy is to have workable results.

These may be inventions, copyrights or even commercial protective rights such as patents, utility models, brands, design, and variety protection act.

For the university, profiling and publicly effective protection rights are important proof of their performance in research and technology transfer, for example as a measure for rankings. In addition, a protective right can be represented by an economic value for sale or licensing. For the university, protection rights are very expensive, so in individual cases the university must determine whether the cost of a patent is worthwhile or not. For the scientist, a registered trademark is a performance record. Furthermore, they can also get finances as a benefit from the right to protection, such as an eventual revenue from the exploitation of the copyright. The inventor usually receives one remuneration of 30%. On the other hand, the scientist is interested, as much as possible, to publish quickly. However, already published works are no longer patentable, since an essential requirement for the patent is the novelty. The scientist has to consider which option is the most remunerative for his project (whether patent or publish the work). The exploitation of intellectual property is seen as a great opportunity, but also with a considerable risk. The goal of university of Hohenheim is to reduce this risk as much as possible and at the same time, to increase the chances involved. There are different possibilities for an economic exploitation: licensing, sales and the way the company is founding. The best use of the intellectual property is always a case-by-case decision of the university with their scientists. Sale and transfer, in the case of inventions, differentiate whether the invention is within the framework of the private-sector funds, funded contract research or publicly funded research project. Alternatively, the university can licence the project in question. The technology transfer strategy of Hohenheim is composed by three main points:

- Communication: The communication of ideas and results to the broad, the public, social interest groups, business and politics is the most central part of the office. The scientific publication is, for the professional discourse, indispensable.
- Consultation: through the consultation of social and political actors and through participation in committees and committees at regional, national and international level

  Hohenheim's scientists use their knowledge for the common good. They also face the discourse and gain insight into the needs of business and society.
- Application: The central goal of the university transfer is the application of its insights for the benefit of society and economy. This includes the protection and the exploitation of Hohenheim intellectual property by the registration of proprietary rights as well as the promotion of business start-ups by students, graduates and

scientific staff. Also within the framework of cooperation and joint projects with companies and other stakeholders from business and industry society finds in direct interaction a comprehensive transfer of knowledge, know-how and technology. The qualification of students is of central importance, scientific staff and their posting to the labour market knowledge and ideas are the backbone of Germany economic and social life ability to innovate.

In particular, Hohenheim's research portfolio covers the food sectors in a unique way, it distinguishes the entire value chain from cultivation to processing (production technology and analytics, as well as economic aspects). The university has also many partners such as FoodConnects which applies to the knowledge and innovation community (KIC) "Food4Future". A special example of the transfer strength of Hohenheim food technology is the Transfer Center Milch, which is a direct contact and service provider for companies of the Food industry.

However, the university also has outstanding facilities beyond joint funding and long-term economic contacts. Due to the location of the university in the middle of the Economic strengths Stuttgart region, it can benefits from its particularly good partnerships with regional partners medium-sized enterprises, but also with public and other social institutions.

Another important feature for the transfer area of the University is plant breeding. In the field of corn breeding, the university is the only one in Europe which is still developing new varieties. Through the worldwide licensing of breeding material, which partly also receives varietal protection, are being generated considerable financial returns.

The Entrepreneurship Chair is also important for the university transfer specific courses and initiatives. The "Start-up Garage Hohenheim" for example teaches business-oriented knowledge for the foundation of the company. A recently approved application to the 'Founding Culture in Teaching' will be possible in the coming years (Hohenheim IP department's strategy, 2016).

CHAPTER 4:

THE CASE OF UNIVERSITY OF PADOVA

3.1. Introduction

In Italy, the discussion on the possibilities which enhance the results of public research, that can be promoted through new entrepreneurship, is still very intense. However, there is also the risk that non-corrected expectations will be drawn for a phenomenon that can be considered an important element of growth and a solid strategy based on scientific and technological knowledge. Some studies also confirmed that the number of academic spin-off has not increased so much from the years when the phenomenon started to spread, hence the 1980s (Lazzeri and Piccaluga, 2012). After all, the relevance of spin-offs has gradually rose with the affirmation of the so-called "knowledge economy", characterized by competitive processes based on the opportunity and the need to continuously introduce new products and services with scientific and technological content. Especially, technology transfer offices (TTOs) have been formed to prompt and inspire the diffusion of the research results, translate them into practise, and ease their interrelations with the other two actors of the innovation systems: industries and government (Algieri et al., 2011).

Italy is a compelling example to observe for different motives. On one hand, Italy is characterized by a dual economy which shows atypical features in relation to other industrialised nations. In fact, Italy's production or specialization is more oriented to traditional sectors rather than innovation and high-tech areas which usually are the starting point for academic spin-off companies. As a consequence, it is interesting to discover patterns characterizing the spin-off creation in Italy that might also inspire policy makers to adapt rules and initiatives to the phenomenon in a more efficient way and increase the international view of the county. On the other hand, it is also very intriguing to observe the Italian situation in relation to a powerful and organized country such as Germany.

Table 3: Facts and Figures of Italy's situation

2015/2016	
Total number of Universities:	97
-Public	67
-Non-Public	30
Staff:	153.040
-Academic staff	95.382
-Non-academic staff	57.658
Students:	1.713.783
-Italians	1.641.693
-Internationals	72.090
Expenditure in R&D:	6.325.700 (Istat, 2014-2016)

Source: own elaboration from data of Miur, Ufficio Statistica e Studi (2015/2016)

Within this context, we will report some data about academic spin-off situation in Italy in relation to Veneto region and University of Padova with a particular regard to the TTO and the Government's role in the process.

3.1.1. Italy's academic spin-off environment

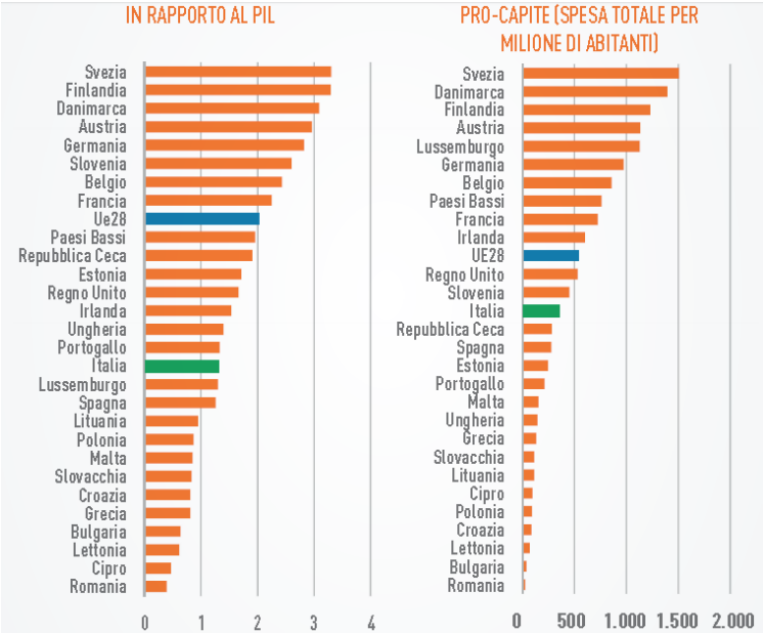
In recent years, there have been several surveys to understand the size of the spin-off phenomenon in public research and to analyse the difficulties and opportunities present on the Italian territory for their development. The problem of Italy has always been the funding of new projects and within it also funds for research and development in the university field. In 2014, R&D expenditure sustained from businesses, public institutions, private institutions, non-profits and universities is close to 22.3 billion euros. With respect to 2013 (around 21 billion euros), expenditure rose with a consistent size, both nominal (+ 6.2%) and real (+ 5.3%). The percentage of R&D intramuros expenditure on GDP (Gross Domestic Product) is 1.38%, up from 2013 (1.31%)[25]. However, Italy is still very far from the forecast of European Union for 2020. From the program Horizon 2014-2020 of the European Union, it is stated that EU countries will have to invest 3% of GDP in R&D (1% of public funding, 2% of private

[25] To see more read the report "Ricerca e Sviluppo" of 2014-2016 by ISTAT.

investment) by 2020, with the objective of creating 3.7 million jobs and making an annual GDP increase of about 800 billion euros[26].

The figure below shows a clear image of where is Italy nowadays in relation to other European countries.

Figure 20: Total research and development expenditure Ue28, Year 2013 (% of GDP)



Source: National Research Program, Miur (2015-2020)

Nevertheless, the spin-off situation in Italy is growing in last years. There are already some surveys about the characteristics and the number of academic spin-off which are created every year in Italy, some of them unfortunately are already obsolete in the sense that several years have lapsed. Despite a little lack of information about the actual spin-off environment in Italy, we will report some studies to give the idea of how the phenomenon is being treated and how it is growing.

Balderi, Patrono and Piccaluga (2011) censused 802 academic spin-off companies created from 2000 both from universities (88,3%) or research institutions (11,7%). They found that the major part of them ended-up as micro-companies, mostly services firms, participated above all by physical people and a small presence of industrial and financial partners in the share capital. Usually, these companies employed ten people and they had about 700 thousand euro of turnover. The authors estimated that the volume of the total business generated by these businesses was around 600 million euros. It is a diversified landscape, difficult to describe, but they tried to give a summary of the main features. The average business age is 5

[26] To see more: https://europa.eu/european-union/topics/research-innovation_it

years and in the last decade there are about 100 new spin-offs per year. In particular, over half of businesses were located in the North and 28% in the Center, with some of the most prolific universities: Polytechnics of Turin and Milan, the Universities of Bologna, Perugia, and the High School Sant'Anna of Pisa, but also some universities in the South (the University of Cagliari and Calabria). Compared to the initial phase of the phenomenon, which saw companies concentrate mainly on ICT (which continues to represent a third of businesses) and electronics, in the last few years a greater number of entrepreneurial initiatives are activated in the departments of life sciences, energy and the environment. The entrepreneurial initiative that leads to the creation of the company is, in most cases (55.1%), of teachers and young researchers, who usually retain their position within the university of origin. There is a growing presence among the founding partners of subjects with previous entrepreneurial experiences, witnessing a progressive acquisition of trust from the part of the "external" context in the successful opportunities of spin-offs. The trend of turnover in the period 2006-2008 shows a growth in average product revenues of 23.8%. The trend in turnover appears to be related to the age of the spin-off business: companies show, in fact, a substantial growth in the early years of life (though starting from very low initially invoiced) that tends to shrink after the start-up phase.

The reference market is predominantly located in Italy, where almost 90% of the revenue is realized. The remainder is distributed of 7% coming from trading in the EU countries and 3.6% produced in non-EU countries. A business extension capacity, therefore, which is reflected in an average export turnover realized in 2008 of 10%, and just under 30% of companies with a positive share of turnover from foreign trade. The major part of these companies were specialized in niche markets.

In Italy, the evolution of the phenomenon of spin-offs can be divided into several phases that have succeeded as the universities gained acceptance and awareness and more generally by the so-called "innovation ecosystem" regarding the potentiality of spin-off processes as a form of public research enhancement. During the first phase, until the first half of the 1980s, the creation of this kind of enterprise was the sporadic fruit of the initiative of individual researchers and professors, with almost no involvement, and even with some more or less explicit disapproval, by the universities at which they worked. It was widespread belief that researchers/entrepreneurs would inevitably overlook their didactic and research commitments and that they would almost automatically find themselves in incompatibilities. In general, the importance of creating new innovative businesses based on recent and innovative research results was underestimated.

It followed a second phase since the second half of the 1980s when research institutions started to become aware of the phenomenon and to get increasingly familiar with the spin-off processes through the procedure of technology transfer activities to existing offices in the organizational structure of universities (such as the Office of General Affairs, the Legal Office, the Research Office), in which attempts were made to address and support the creation of this type of business. The third phase, towards the end of the 1990s, saw the gradual acceptance of the phenomenon by Italian universities, which led to a radical change in the attitude of universities towards spin-offs of public research. In fact, at that time, most research institutions began formally building their own Technology Transfer Offices (TTOs), devoting specific human and financial resources to research enhancement activities and adopting formal supportive policies for spin-offs. It is at this stage that universities are launching actions to raise the awareness of researchers and to train them for entrepreneurial activity. At this first wave of enthusiasm for the phenomenon, in the early twentieth century, a fourth phase, characterized by growing awareness by universities on the need to rationalize and make more effective the provision of support services to business creation Spin-off through a process of progressive learning of practices, procedures and routines by newly established TTOs and co-ordination with other stakeholders who in the downstream stage intervene in the process, such as incubators, investment funds, industrial partners, etc. At this stage, there was the experimentation of new ways to encourage academic spin-off activities, also with the participation at the capital share by the university. Currently, we are in a sort of fifth phase and in the national context there is widespread satisfaction with the results achieved, especially in terms of the number of companies created, of the scientific and technological sectors concerned, but also in terms of geographical spread across the national territory (Lazzeri and Piccaluga, 2012). This slow progress towards the adoption of internal rules on spin-offs is not to be attributed to individual universities, but is provided by Article 2, paragraph 1, letter "e", number 1 of Legislative Decree 297/99 imposing to Universities to adopt an internal regulation to regulate the entire system of university spin-offs[27]. In general, Italian universities define an academic spin-off as a company where there is the participation of the university in the capital share of the companies.

A study by Salvador (2007) interviewed about 20 academic spin-off companies from four different universities in Italy and found that the most widespread model of spin-off is the one which does not have any particular financing needs to start because it is a spin-off that operates in the field of consulting, design, of applied research, etc. The activities carried out by such companies require basically a good baggage of ideas, coupled with a background of

[27] See more at: http://www.miur.it/0006Menu_C/0012Docume/0098Normat/0070Riordi_cf3.htm

knowledge developed within the university, some computers, telephones and internet connection without the need for large initial investments. They are mostly service companies. Juridically, they are spin-off, but they are quite different from production spin-offs. In general, the regulation for the creation of spin-offs of Italian Universities merely define the term "academic spin-off" in a very general way, without putting too many constraints on the company's requirements. It is enough if there is a professor or university researcher in the social companionship. The initial capital share is tendentially low, generally the minimum required to form the company, almost all enterprises take the form of ltd., the initial capital is more than enough to begin.

The total amount of spin-off from research which Italy has now is 1.196 (Spin-off Italia database). The survey conducted by Netval (2016), found that there is an increasing tendency to create TTO in every Italian university, especially from 2014 the 88,7% of the Italian universities own their own TTO. In the most cases, 86,8%, the TTOs offer their services to only one university, and the 42,6% of the universities own or participate in a scientific park and the 49,2% in an incubator.

Table 4 : funds for scientific and technological research

Source	Percentage
R & D contracts and technical services financed by third parties	20,3
Region and local Authorities	19,7
Central Government	15,5
Own University funds	10,4
European Union funds	15,1

Source: own elaboration from data of Netval (2016)

Another interesting fact is the distribution of the spin-off in Italy. They are more present in the North (47,6%), but they have been developing also in the middle and South of Italy with respectively 29,3% and 23,1%. The regions that are more productive in this sense are Tuscany (12,6%), Piedmont (9,7%), Lombardy (9,6%), Emilia-Romagna (9%), Puglia (7,7%), Lazio (7,3%), Veneto (6,5%), Liguria (5,1%), Friuli and Marche (4,9%) and Campania (4,1%).

3.1.2. Veneto's academic spin-off situation

In Veneto there are three big and famous universities: University of Padova, University of Venice (Ca Foscari) and University of Verona. Innovation is one of the key factors for the development of the Veneto economy. The use of knowledge effectively increases productivity and well-being and creates new market opportunities. Italy and Veneto continue to be considered moderate innovators with a spending on research and development much lower in relation to the GDP European standards. However, this data can hide some underestimation: using the number of employees devoted to research and development or the share of innovative businesses, it emerges that the distance of Italy and Veneto is less profound. This means that, especially for Veneto, there are wide margins particularly in terms of collaboration, technology transfer and human capital (Rapporto annuale del Veneto, 2016).
In recent decades, the network of reformed technical institutes, public incubators, science and technology parks, and special agencies for innovation has not been able to play the role of "bridge" between research and industry as expected. The same university, called into question as a new incubator, does not adequately performed the expected function (scientific training and start-up). The results are in the eyes of everyone: a progressive decline in productivity and a growing trend gap between supply and demand (Il manifesto del nuovo manifatturiero, 2017). International rankings on innovation are constantly returning to the image of Veneto as not present among the realities of excellence. The current situation of delay in the dissemination of new generation networks (NGA) in Veneto (think that only 15.9% of the population currently has a connection to at least 30 Mbps against a 62% European average) (Digital Agenda ScoreBoard, 2014) represents a serious obstacle to the ability of Veneto companies to seize the full opportunities generated by the digital economy compared to its European and world competitors. In all the weaknesses highlighted, one big problem is the fragmentation of the regional innovation system and the decision to replicate choices and solutions that are valid elsewhere, but not practicable in the contextual conditions in which Veneto is now. There are no huge industrial realities that can drive innovation and the integration between manufactory and the tertiary innovator struggles to generate an integrated system. Hence, Veneto Region tried to replicate the start-up model that goes quickly on the market, imagining universities that produce graduates who can start successful businesses, incubators have been funded to cross the talent of young people with their successful venture capital expectations. This is why in the Veneto there are science park, technology districts and incubators, start-up support programs and more. These projects have been supported by

politics, universities and many institutions committed to the technology transfer front. However, the budget of these initiatives, evaluated over the last fifteen years, can only be negative. Replication of projects which have thrived in other contexts, has often been a failure in this region (Il manifesto del nuovo manifatturiero, 2017). It is in this context of delay that Veneto Region is working to encourage innovation and collaboration between universities and companies. In the next table, we report the SWOT analysis made by the Department of Economics and Development, Research and Innovation of Veneto.

Table 5: SWOT analysis of Veneto

STRENGHTS: High Density Manufacturer Region; Presence of Research Centers and Excellence Development (Universities, Science Parks, Research Centers and Technology Transfer Centers); Knowledge and capacities available from University Research; Regional Liabilities to Support Innovative Business Development and Internationalization; Region high vocational district with low-tech specialization; Presence of leading global companies; High propensity to export; Widespread entrepreneurship; Presence of skilled workers; Region with a strong tourist vocation; Wide cultural and environmental heritage; Excellence in innovation of production processes.	**WEAKNESS**: Under-utilization of the knowledge system by enterprises; The supply of centers of research and knowledge is far from business needs; Districts difficulties to develop innovative projects; Unrelated research centers; Limited use of venture capital; Poor use of ICT technologies in micro-businesses; Poor availability of transversal skills training; Complexity of access to funds; Low utilization capacity of European funds; Merit in research based only on basic research (publications) and not applied; Exposure to international competition in subcontracting; Lack of structured training and innovation; Less developed entrepreneurship training system in the field of mechanics; Poor system capacity.
OPPORTUNITIES: High level of specialization in the traditional sectors; Increased presence of innovative and technological companies; New policy tools for aggregation and enterprise networks; Participation and national technology clusters; Complementarity of expertise, knowledge and specialization among European clusters; Complementarity of knowledge and specializations between different clusters; Unspecified potential in terms of research and development; Innovation in production processes.	**THREATS**: Changing consumer needs; Loss of competitiveness in emerging sectors; Loss of manufacturing skills by specialized districts; Brain drain; Difficulties in accessing to credit and funds; High transport costs.

Source: Assessorato all'Economia e Sviluppo, Ricerca e Innovazione

In a study conducted by University of Padova for Unioncamere Veneto (Apa, De Marchi, Grandinetti, Sedita, 2016) on 181 Veneto manufacturing companies, it is shown that the role of the University is crucial as innovation partner. In fact, they outline that universities collaborate with a percentage of 19,4% with innovative companies and with a 36,5% with very innovative firms. They support innovation as actors complementary to investments in internal resources. The authors also found out that without being able to hypothesize causal relationships, there is no doubt that companies that have benefited from regional innovation facilitations show superior performance. Several measures have been adopted in Veneto region to facilitate the creation or development of companies, especially amplifying the relations between university and industry with the encouragement of new processes such as the academic spin-off formation.

The "Innoveneto" platform, created by the Region for Regional Mapping of Research Centers (Public and Private) and existing Centers for Innovation and Technology Transfer (CITT), is the basis for facilitating a meeting between businesses and Research Centers: in this way, it will facilitate the process of innovation and transfer of new knowledge, technologies, services and products, making it a useful tool to identify the actions that are the subject of this action. The operator of the platform is Veneto Innovazione SpA, whose functions include the creation and subsequent updating of the "Regional Catalogue of Research", in which the Regional Innovative Networks recognized by the Regional Council. Even if the economic and innovative situation of Veneto is not the best of Italy, the regional strategy is geared to increasing the incidence of innovative specializations in pervasive application areas of intense knowledge, in particular by supporting spin-offs and innovative start-ups in order to reduce the gap at national and European level. The main objective is therefore to produce more new entrepreneurships that inherently possess those characteristics that are considered to be capable of maintaining the necessary levels of competitiveness, flexibility and innovative capacity over time, and that, through the implementation of research-based and on innovation, are necessary to consolidate and increase the competitive advantages in the areas identified by RIS3 (Research Innovation Strategy 3).

3.2. Funding Programs

The new Cohesion Policy 2014-2020 Programming Cycle expects, as an “ex-ante” condition for the use of community resources, that national and regional authorities study research and

innovation measures with the goal of "smart specialization". This in order to permit a more effective exploitation of structural funds and to create collaboration among EU, national and regional authorities. Within this context, each Member States Regions must scheme their Smart Specialisation Strategy blueprint, regarding accessible resources and attitudes, identifying the competitive advantages and the technological specializations compatible with their ability for innovation and outline the public and private support measures necessary for research, technological development and innovation[28].

In Veneto, it is called POR ERDF 2014-2020 and it is the tool through which the Veneto Region, thanks to about 600 million euros available from the European Union and from the state and by the Region itself, will develop from 2014 to 2020 a social and economic growth plan that will affect the research and innovation, the digital agenda, and industrial policies, energy and environmental protection. The European Regional Development Fund, called the ERDF, is one of the Funds Structural and European Investment Funds which goal is to fund projects development within the European Union. Especially through the ERDF, the Union Europe pursues its own "policy regional", to achieve the fundamental goal of economic and social areas cohesion between the regions of the Member States, hence, a harmonious development of the Community as a whole[29].

Figure 21: POR's Logo

Source: "Programmi Comunitari" on Regione del Veneto webpage.

Especially for academic spin-off companies, it is very important action number 1 of the program aimed at supporting research projects for enterprises employing researchers (doctoral and magistrate graduates with technical-scientific profiles) at the companies themselves and at supporting the creation and consolidation of innovative high-intensity knowledge-intensive start-ups and research spin-off initiatives.

[28] See more at: https://www.researchitaly.it/en/smart-specialisation-strategy/ and https://www.startupeuropa.it/
[29] See more at: https://www.regione.veneto.it/web/programmi-comunitari/assi-e-azioni

This is an important policy document that identifies, on one hand, the strengths and weaknesses of the regional economic system and on the other hand, it redirects funding for research, innovation and investment in businesses to the driving economy sectors, which can help bring the region to excellence. In particular, Veneto region wants to improve these sectors: agribusiness (agrifood), manufacturing, sustainable living and creative industries[30].

From the funds of Horizon 2020, there is a measurement for Veneto Region that addressees Micro, Micro, Small and Medium Enterprises (also spin-off of research) recognized as innovative start-ups. Projects worthy of applying for support should include the development of activities in the area of the Smart Specialization Strategy (S3) Regional, in particular ICT, High Tech and Innovation to contribute to the manufacturing sector for the creation or development of new product systems, processes/technologies, production systems or the development of new business models, organizational, financial management and marketing processes of R & D results. The funds will be spread in these investments: materials (acquisition of machinery, equipment, furnishings strictly functional to business activity); intangible (acquisition of patents, licenses and software specifically related to business activity); instruments and equipment (hire or hire of technical-specialist equipment); specialist consultancy and external services of a technical-scientific nature (used solely for business activities such as laboratory tests, testing and prototyping activities, as well as costs for the use of research or testing laboratories, IT services and ICT) and of business. The latter is not related only to ordinary administration but also to the business plan by supporting: the company analysis in order to define the financial plan and the competitive analysis of risk and market; the definition and validation of the business model; the start of business management; the commercialization by analysis of commercial initiatives; the study of competitive positioning and development and planning of corporate marketing; the phase of patenting and protection of intangible assets. Finally, funds for promotion such as expenses related to the promotion of the enterprise such as, for example, services, fairs, events, showrooms, temporary shops (up to 20% of the project). Expenses inclusive of a minimum of € 15,000.00 and a maximum of € 200,000.00 are eligible (Euris, 2017)[31].

With regard to funding, Italian businesses continue to show greater propensity for traditional financing channels, such as banks grants, which are often no the best choice to support growth, development and innovation processes.

The Miur, with Ministerial Decree 594 of July 26, 2016, has established new procedures for interventions aimed at supporting core research activities carried out by universities and

[30] See more at: http://euroinnovazione.eu/104-milioni-di-euro-per-la-ricerca-e-linnovazione-delle-imprese-che-investono-nel-veneto/

[31] See more also at: https://bandi.regione.veneto.it/Public/Dettaglio?idAtto=1795

public research institutes supervised by the Ministry, on the financial resources of the Investment Fund in Scientific and Technological Research (FIRST). Compared to the past, this Decree simplifies the selection procedures and aligns procedures with best international practices, whose highlights can be summarized as follows.

- Selection phase:

The National Research Fellowship Committee (CNGR) defines, in compliance with Law 240 of 2010, the criteria for evaluating projects and designates internationally recognized scientific experts to be part of the Selection Committees, equivalent to everything and everything to the "panels" of European projects. Each Selection Committee (in accordance with the international peer review practice, referred to in the same Law 240 of 2010) identifies, by means of an anonymous procedure, three external experts for each project. One of them, referred to as the "rapporteur", commits the task of drafting, on the basis of opinions issued by other experts, a provisional Evaluation Summary Report (ESR) on which the consent of the other two experts.

Once the consent has been obtained, the provisional ESR becomes automatically definitive. In case of failure to reach consensus, the drawing up of the final ESR, taking into account the initial opinion of the three experts and the comments made on the provisional ESR, is the responsibility of the Selection Committee. At the end of all evaluations, the Selection Committee sets the ranking of the projects and defines the appropriate cost and the relevant contribution for the projects eligible for funding, which will be paid by Miur in a single tranche within 60 days.

- Run Phase:

There is no need for approval for any variations in the economic articulation; only scientific variations are subjected to modification of the objectives of the project. It guarantees the portability of the projects resulting from the transfer of the headquarters or the entity of the scientific manager. Accounts are carried out only at the end of the project, within the next 60 days, and exclusively by means of a specific telematic procedure, without any need to produce paperwork. Administrative-accounting audits are carried out exclusively at the end of the project (Law 35 of 2012), resulting in possible recovery of sums already paid out. Scientific reports made 90 days after the end of the project, and transmitted telematically to ANVUR, competent for ex-post evaluation of research products.

Besides, the main public funding instrument for academic spin-offs at national level is managed by INVITALIA and is called Smart & Start[32]. This is a government-funded measure

[32] See more at: http://www.smartstart.invitalia.it/site/smart/home.html

that boost new business in the digital economy and the spread of results from the research field.

Figure 22: Smart&Start Italia's logo

Source: Smart&Start Italia's webpage

Smart&Start Italia works in three main areas of innovative start-up:

- Companies that have a high-tech, innovative business idea;
- Companies that develop products, services or solutions in the digital economy;
- Companies that exploit commercial opportunities resulting from research.

The aid is composed by an interest-free loan to support capital investment and operating costs regards to the beginning of the business. Start-ups which are located in the South of Italy or in regions that were affected by earthquake, can also take advantage of a grant. The new beginners of start-ups (max 12 months) are supported by managerial and technical mentoring. The maximum repayment period for the loan is 8 years and its amount is up to 70% of the business plan expenses that qualify for funding. The loan amount can cover up to 80% of the expenses if the start-up consists entirely of people under the age of 36 or women, or it includes at least one Italian Ph.D. (or equivalent). The Ph.D. must have been awarded in the last 6 years and the recipient must have been permanently engaged abroad, either in research or in teaching, for at least 3 years. After the application has been reviewed, the applicant will be contacted within 60 days. The main characteristics that will be evaluated are: how relevant and applicable the skills of the applicants are with regard to their business plan; how innovative the idea is, typically in terms of new product, service or solution the market potential, strategic positioning and marketing strategies the economic and financial sustainability of the business plan the technological and operational feasibility of the business plan.

Another relevant program to mention is The Start Cup Veneto 2017 (SCV) Award which intends to stimulate research and technological innovation to support the economic development of the regional territory, giving concreteness to the participants' ideas and putting them in a position to adequately address the start-up phase of a new business.

Not only money backing, therefore, but also training and consulting on the most important aspects of business management. Start Cup Veneto is a competition between people who develop innovative entrepreneurial ideas, funded and realized by the Universities of Veneto in collaboration with FabCube and IXL Center. Anyone can participate to the program, forming a team of at least 3 people and proposing an innovative idea of product or service in any business sector.

Three prizes are available: Start Cup Veneto Prize with which the 5 winners will receive cash prizes for a total prize pool of € 20.000, they will also benefit from an angel (consultant / trainer) to draft the business plan and eventually participate in the National Prize for Innovation 2017 with the winners of the other 17 Italian Start Cups. "Wannabe at Startupper" special prize is a free training course offered by the Project Life - Catholic for Young People to all 10 groups selected during the Night of Angels. The goal of the journey is to support teams in developing personal skills and processes that are useful for designing and implementing their business projects. FabLab Special Award aimed to be awarded to two teams that have made pre-registration online by the required date, provides for 3 months of incubation at one of the FabLab members of the FabCube association, with access to coworking spaces, labs, and mentoring activities for give shape to the project[33].

The Association Start Cup Italia now has 44 members associated with universities and incubators academics and is promoter of two important initiatives: the National Prize for Innovation - PNI, which select the best innovative business ideas, and the Italian Master event Startup Award formerly the Start Up of the Year) which rewards the young Hi-Tech company which has achieved the greatest success of the market.

PNICube has the following objectives:

- To encourage the birth of incubators university;
- Exchange experiences between members and favouring mutual cooperation;
- Sensibilize and promote the adoption of policies in favour of business incubation initiatives;
- Acquire resources directed at activities of enterprise creation;
- Promote and support partners in the international collaboration;
- Make creating start up from research[34].

From this general overview, it is clear that the regions and the central government are putting huge efforts to further develop these areas and promote innovation through universities and industry. Even if Italy is still far from the average performance of EU countries, there is an

[33] See more at: http://www.startcupveneto.it/Informazioni
[34] See more at: http://www.pnicube.it/

increasing tendency and focus on ever clearer objectives to make this country more competitive and award young entrepreneurs.

3.3. University of Padova

"Universa universis patavina libertas", the motto that has always characterized the University of Padua, and also the spirit of freedom of culture and expression that led a group of students and teachers to leave the University of Bologna for Padua. Although study and research dates back many years earlier, 1222 is recognized as the foundation year: that year is indeed the first record of a regular university organization.

The University of Padova is one of Europe's oldest and most prestigious seats of learning; it is a multi-disciplinary university with the goal of offering its students with both professional training and a solid cultural background. This university is always in changing to adapt to the new tendencies of the world and the labour market. For example, the Healthcare degrees cover a various range of new classes such as Pediatric Nursing (Medical School), or Neuroscience and Neuropsychological Rehabilitation (Psychology). Engineering degree courses are available in the fields of Civil, Architectural, Environmental, Industrial and Information Engineering. The university is also working to update its courses in Environmental Sciences and Technology (Agriculture Sciences), and consumers with Safety and Hygiene of Food Products (Veterinary Medicine) to protect environment. Moreover, its Pharmaceutical Biotechnologies (Pharmacy) is very important in researching into hi-tech products with also a course in Materials Science (Sciences). The offer of the university covers also Humanities, such as History and Conservation of Artistic and Cultural Heritage (Arts and Philosophy), and on teacher training with a course in Primary Education (Education). Besides, Padova is one of the best University of Italy in the courses of Law, Economics, and Business Management alongside courses that analyse complex social systems such as Sociological Sciences (Political Sciences) and Statistics, Population and Society (Statistical Sciences). There is also the possibility for excellent students to be chosen to take part into the Galilean School of Higher Education[35].

[35] See more at: http://www.unipd.it/en/university/overview/university

Figure 23: University of Padova location

Source: University of Padova website

3.3.1. Organization and TTO

"A University spin-off is a business founded by researchers to enhance the results of their own research activity and scientific knowledge, in which University of Padova may be a partner. Researchers, as partners, share the profits. From the legal viewpoint, a spin-off is no different from an ordinary business enterprise. The particularity of spin-offs lies in in the fact that they are promoted, created and developed by one or more people who have a close relationship with the research world and use the know-how developed within research organisations in their business activity" University of Padova definition of academic spin-off. The University of Padua encourages the formation of spin-offs, in relation to the fact that these companies represent an amazing way to transfer technology to the market. In particular, the businesses of the spin-off firm must be precisely independent from the institutional and commercial tasks which researchers can operate within the University. As almost in every university, there is also the TTO which provide management consulting services to researchers that have a good idea to initiate a spin-off company and support them in articling

the business plan and in coaching industrial and financial partners. If a student or researcher of the university has the wish to begin a spin-off firm, he/she can contact the TTO for scheduling the first information meeting. After that, the individual must draw up a spin-off proposal to the spin-off

Commission of the University using the form and the exhibits indicated in the Spin-off Regulations. The commission is composed by the President Mr. Dughiero and other four members (Soramel, Merigliano, Bonetto, Drigo). The university of Padova owns also an incubator "Start Cube" which permits to host these kinds of companies and helps them to develop. Start Cube is dedicated to newly established or under construction companies that are characterized by the innovation of the product or service that is the subject of business activity. Provides space, equipment, and services on easy terms in order to reduce the burden of starting the business as an accelerator of the company's journey, alongside startupers in a mentoring and tutoring course.

Galileo Scpa Science and Technology Park (hereinafter referred to as "PST") is the head of the Start Cube - University Business Incubator. This project born from the initiative and with the financial support of Fondazione Cassa di Risparmio in Padova and Rovigo, in collaboration with the University of Padova. The project is supported by the Foundation's contribution. Start Cube offers two types of incubation ways:

- Real Incubation: modular office partitions with mobile partitions that are rented to people who are interested in using a cost-effective office site and a range of functionalities to set up and start their own business venture. Some services will be offered to users free of charge, including rent, others at reduced rates, which will be governed by special agreements stipulated with specialized external suppliers. The university connotation will bring remarkable external visibility and positive image repercussions to user-created businesses.
- Virtual Incubation: some companies, especially in the first phase of growth, do not require the use of offices, but they still need advisory services to support the development of business activity. In these cases, Start Cube offers virtual incubation that translates into the same real-life services except for office use. For some businesses, virtual incubation is a rooftop of real incubation, for others who already have an office elsewhere, it is an important support tool[36].

The total amount of academic spin-off companies created in this university is about 47 and they have kept, during these years, a database about their characteristics and the interviews made with them to study the phenomenon.

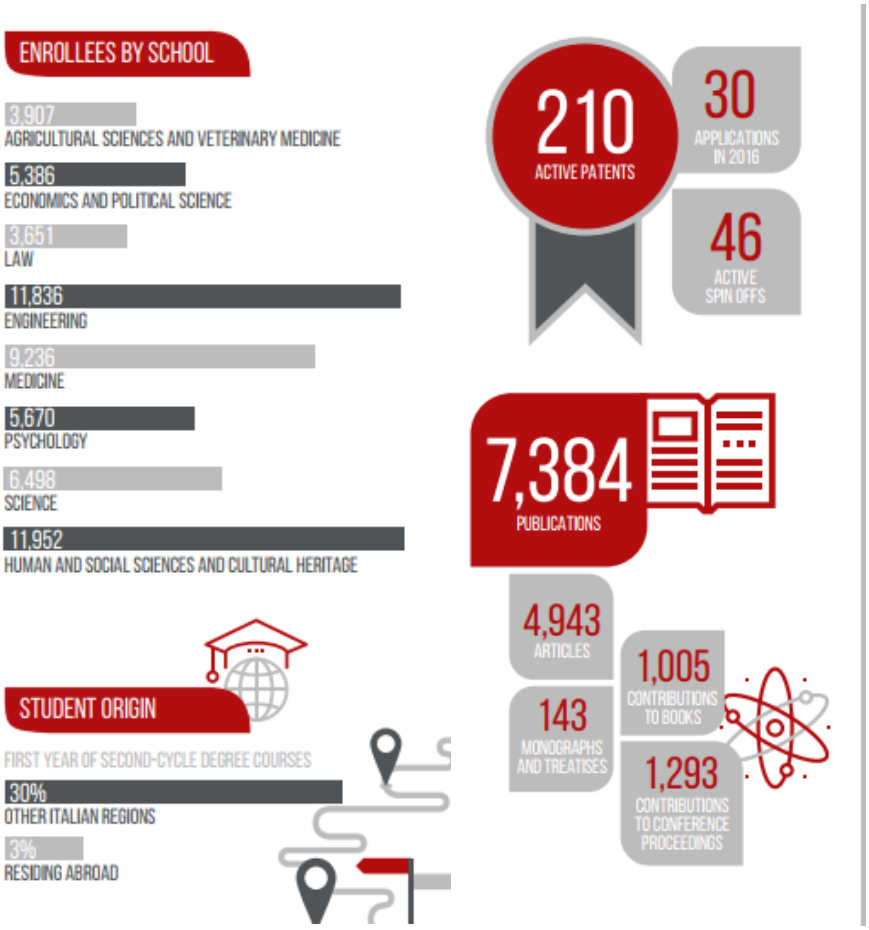
[36] See more at: http://www.startcube.it/

Besides, university of Padova is very well organized thanks to its own infrastructures directed to develop the entrepreneurship culture and relation between the institution and the job market and its initiatives. One of its main tools to spread innonvation is Unismart which is the wholly-owned subsidiary of the University of Padova with the duty of managing all the technology transfer and innovation consulting activities directed to companies, industrial associations, professionals, investors, banks, and other public and private bodies (both on a national and international scale). This organization symbolizes an efficient way to commercialize the most powerful multidisciplinary research results and intellectual property through the innovation chain, using the skills and networks of the university. About 5.000 from 32 departments researchers are supported by Unismart and also 60.000 students in exploring their research to access the market. Another action promoted by the university is BAN Veneto. It is a Business Angel Network, a meeting place (physical and virtual) among newcomers who have just started a start-up in the technology and investor sectors. It also provides mediation and support services to meet those who offer technology and those who are looking for ideas for entrepreneurship or who want to find solutions to the technology problems of their business.

BAN Veneto is a temporary association of companies between the University of Padua, the Galileo Scientific Science Park and Confindustria Padova. It is affiliated with IBAN, the Italian Informal Investors Association.

After this general overview, we have given proofs that the entrepreneurship culture is quite well established in this University and it is continuously renovating itself following the tendencies of the job market. Below, you will find some facts and figures about University of Padova to comprehend in a better way which is the environment that surround the entrepreneurship culture.

Figure 24: Facts and Figures of University of Padova



Source: University of Padova webpage

University of Padova was ranked first for quality of research by the National Agency for Evaluation of the University System and of Research (Anvur 2017). As we mentioned before, it is continuously investing in research. Among its objectives there is a new recruitment plan and the expectation to reach 300 posts for researchers by 2019. The total budget for scientific research is about 60 million euros per annum, including the funds from fundraising activities and 22.7 million euros given by the University for 2017. The collaboration with European Union is strong and there have already been 81 projects funded and about 32 million euros received from the beginning of Horizon 2020.

3.3.2. IP's legislation

In this section, we will report the IP rules of University of Padova taken from the official statement of the institution.

IP regulations of University of Padova may give lead to to patentable inventions, utility models, models and ornamental designs, software, databases, know-how and any other innovation susceptible of protection. Copyright does not fall within the scope of these Regulations. In terms of intellectual property, relations between the University and the grant holders or research staff under contract of collaboration are governed by their respective contracts. As for relations between the University and the PhD students and students, it will be the responsibility of project's supervisor to communicate these commitments to the grantee and collect their commitment to transfer the patent rights to the University itself.

University employees have the right to patent, in their own name and at their own expense, inventions and innovation as any other protectable intellectual property, made during performance of their duties, by giving notice to the University.

The University may propose the inventor to transfer all or part of the patent rights. Inventors wishing to make use of the University's technical and financial support in the patent filing process can transfer the right to file a patent application, free of charge, to the University by subscribing to a specific contract. If the right to submit a patent application is transferred to the University, this will be without prejudice and within the inventor's moral rights to be recognised as authors of the invention. These Regulations shall also apply to inventions made by employees of the University working jointly with others who are not employed by the University. The University has the right to patent an invention created by its employees and as part of research activity that was financed by third parties. Under a contract or funding for research activities, the University may provide for the transfer of the patent application of the invention. In that case, the patent application shall be filed jointly by the University and funder and at the expense of the funder. The University will enter into a contractual agreement to transfer to the funder his share of the patent application, if requested within one year from the filing date, in return for a fixed fee. The aforementioned payment will be in addition to the payment made to the University for performing research activities and must be not less than 10% of the same.

In special cases, and properly justified by the research department that signed the contract, the share for the payment of the patent application may be less than the minimum stated above. In this case the contract must receive a favourable opinion from the University Patents Commission and, before being signed by the Department, must be approved by the Board of Directors. If the payment of the patent application is transferred from the University to the funder, this will be made formal through a contract that will respect the conditions agreed in the research contract. This transfer agreement will be signed by the legal representative of the University without the need for approval by the Board of Directors.

In the event of transfer of ownership, the funder cannot unreasonably deny the right to use the patent for scientific and educational purposes for more than 18 months after the end of the contract. If inventors create an invention they consider patentable, they are obliged to confidentiality regarding the research and its outcomes. In particular, in order to allow for valid patenting of the invention, inventors must refrain from publications of all kinds, including ommunications and posters presented at scientific conferences. Also every verbal communication with industry and other stakeholders about the invention must be preceded by the signing of a non-disclosure agreement (Secrecy Agreement or Non-Disclosure Agreement). Failure to comply with the provisions makes the invention non-patentable. Inventors interested in transferring patent rights to the University in order for it to file a patent application on their behalf, must send a "Patent Proposal" to the Universit. In the event that non-University employees participate in the invention, they may assign their patent rights to the University and participate in the distribution of profits in the same way as the employees of the University.

The transfer of patent rights to the University by the inventors may be total or partial. If it is partial, the inventors must indicate on the patent proposal as to which other parties they intend to transfer the patent rights and what the percentage of ownership of the patent will be.

In the Patent Proposal, every inventors must also specify the percentage of their original contribution. In the absence of a declaration, it is assumed that all inventors contributed to the invention in equal measure.

If the inventors choose to file the patent application in their own name or to sell to third parties the right to patent their invention, they must notify the University within 30 days of filing the patent application or the stipulation of the sale contract to third parties.

All communications with the University should be addressed to the head of the University's Central Administration in charge of technology transfer. If the costs are to be covered by the Department, the inventors must attach to their Patent Proposal a statement issued by the Department's in support of this. If University funds are required, the Commission for University Patents, comprising experts appointed by the Rector, will vote on whether to proceed with the patent filing process on behalf and at the expense of the University. Members of the Commission are bound to strict confidentiality regarding the information they become aware of in the evaluation phase of the Proposed Patent.

The Commission for University Patents will also decide on whether to cover the cost of an international extension (PCT or other procedures) to a national patent application and on any other course of action that may impact the use of the University's patent fund.

The University has the right to transfer to third parties the right to industrial exploitation of the patented invention, through licensing or transferring of the patent or of the patent application, which must be approved by the University Board of Directors, after consulting the Commission for University patents. The University is committed to involve the inventors in negotiations with third parties for the sale or license of the patent, while keeping its aim of maximizing the proceeds from the sale of the patent, in terms of financial compensation and financing research activities conducted by the inventors. In the event that the University authorises a spin-off company, set up by the inventors and aimed at the industrial exploitation of the invention, the University will sell or confer or transfer the license patent to the spin-off.

In the event that an employee of the University files a patent in his own name and has an income through the sale of the patent or the grant of licence to third parties, the University is entitled to a share of the profits after patenting expenses. It is established that a share must be of 40%. In the event that a patent application has been filed by the University, revenues from contracts for the sale, license or option must, first, reimburse the costs incurred by the structure for patenting. In the cost calculation, future costs should also be included, even if not yet actually incurred at the time of entering into the agreement or assigning of a patent license. The University may make use of specialised consultants and licensed professional specialized in filing patent applications. The costs of the professional services of consultants/agents must be included in the costs of patenting.

After repaying the costs of patenting and the assignment of any shares to others outside the organization, the profits will be distributed as follows:

- 60% to inventors;
- 40% to the University;

The portion allocated to the University will be divided as follows:

- 30% to the Central Administration, and 10% to the department the inventors are affiliated with, if the patent application has been paid by the University Patents Fund;
- 10% to the Central Administration, and 30% to a part of the the department the inventors are affiliated with, if the patent application has been paid by the department;
- 20% to the Central Administration Department and 20% to the department the inventors are affiliated with, if the patent costs were not incurred patent by the University.

The fee payable to the Central Administration is intended to fund the University Patents.

The University may sign specific cooperation and research agreements (for example for projects financed by public or private institutions), or framework agreements (as part of multiyear research projects in collaboration with public or private entities and industries) that

provide for agreements on the patenting of inventions not according to these Regulations. Such agreements will be submitted to the Board of Directors (The University of Padova's Patent Regulations).

CHAPTER 5

THE COMPARISON BETWEEN THE TWO UNIVERSITIES

4.1. Introduction

After having reviewed the literature regarding the academic spin-off phenomenon and having showed the respective situations in Germany and Italy, specifically at Hohenheim and Padova, we will outline the main differences and results that we found during this research.
The analysis started in April 2017 until July 2017. During this time framework, we had the possibility to interview some people at University of Hohenheim who are employed in the Entrepreneurship and Research department and currently working in the TTO of Hohenheim.
Besides, we also had the chance to contact several companies created thanks to the support of the university. The total amount of companies which we tried to contact is about 33 and we found the contacts on the webpage of university of Hohenheim. We succeeded in interviewing only seven of them for different reasons. First of all, the list on the webpage of Hohenheim University is not updated and it doesn't differentiate between start-ups or spin-off companies. Moreover, in the list there were also companies which have been founded by former students of Hohenheim after many years from their graduation. Thus, the list was not useful as we hoped and some companies were also discontinued. In addition, only 15 companies answered us and even if we tried to contact again the others, we didn't receive any response. From the replies that we obtained, we were able to understand that the list was not only about academic spin-off companies, but just an overview of the initiatives begun with or without the support of the university. While we were carrying out this analysis in Germany, we were also checking the data base of academic spin-off companies of Padova. University of Padova has been very organized keeping an updated data-base composed also by 16 interviews with some spin-off firms. The main objective of this paper was to find some differences and similarities between the two institutions in the way they support academic spin-off and what these companies think about the entire process. In order to show our results, we will compare the interviews we conducted in Germany with those of University of Padova. Afterwards, we will examine the characteristics of the TTOs and the steps to spinning out companies.
As a consequence, we will figure out which are the topics that need further research and improvements from both universities.

4.1.1. Interviews with seven Hohenheim's spin-off companies

In the six months, we were at University of Hohenheim, the process of collecting information was very complicated. Nevertheless, we succeeded in interviewing six academic spin-off companies and one non-academic spin-off company. In this paragraph, we will report which are these companies with a brief description.

The first company we interviewed was GecoGardens founded by Bastian Winkler who studied in Hohenheim since 2006 in the Agriculture Science area and later on Bio-based products and Bio-based energy. He had the idea of creating a spin-off company when he went to South Africa for his master thesis on renewable energies for small holder farmers. When he arrived there, he figured out that the problem was not energy, but food production. Hence, his partner organization came up with a system for intensive production of fish, vegetables and rise. They worked together to further develop the system and use it to solve the problem. Then in 2013, Mr Winkler thought that this kind of production was very suitable also for cities, because people don't need soil, but artificial pots to growth vegetables in water. So, he started to work on the Geco System, which uses warms instead of the fish and there is also some kind of mixture included that allows people to put it in their organic kitchen wastes and then warms decompose it and the nutrients are washed out in the plants of the garden system. He was able to develop the system also in India and Brazil.

Figure 25: Geco System

Source: Uni-Hohenheim webpage

After Geco-Gardens, we talked with Martin Allmendinger founder of OMM Solutions which develops side projects that come out of their daily business. They are experts in problem solving; innovation; consultancy; software and ventures. Their major competitors are Consulting Firms with Technology knowhow in the field of digitalization. Their team is composed by three graduates, talents in the field of programming, project management and sales. They started as a university spin-off company, but they didn't get any useful support.

Figure 26: OMM solutions logo

Source: OMM solutions webpage

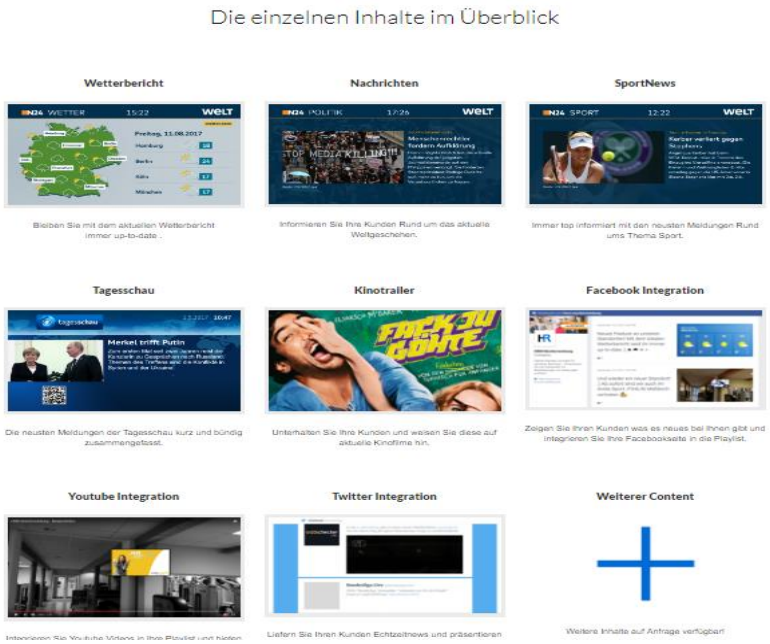
Another amazing successful case that we had the opportunity to interview is Anders Life founded by Andrea Haas. Mr Haas founded his first company about 10 years ago and he had offices in India and Munich, where he studied. He told us that after about 8 years, from the creation of this company, he decided to start a PhD in Hohenheim and he had the idea for his second company in 2016. What they are doing is basically using virtual reality to offer to therapists in hospitals a new method for the therapies. The product born with the idea of helping patients that lay on their beds for a very long period, such as cancer patients, and with this new product they can somehow go out from the hospital's room, it is like a moving therapy. They are doing a lot of tests due to the fact that they need medical evaluation of the product to implement it for real in hospitals and it is a very long process. Besides, they participated to EXIST and they got the funds. They applied for public funding due to the fact that it is very difficult to receive private capital to support the company because it is a high risk product and still in the evaluation phase, hence investors want more guarantees.

Figure 27: Anders Life product

Source: Anders Life Website

The next one is Hrm-bs by Christian Rebholz who had the idea for his company in Wien. He was visiting a friend and he noticed that there were a lot of lockers around the city. Later, he discovered that the lockers were charging spaces for smartphones and he thought why not to bring these products to Germany. He started in 2014 with his first client, a gym near Konstanz lake which asked him to add also screens on the docking stations to transmit advertisements. Now, his team is composed by other two people, one student that is studying with Mr. Rebholz the master in Management at Uni-Hohenheim and one graduated who is in charge of programming and informatics staff. They are trying to further improve their product and find more clients thanks also to the Uni-Hohenheim network that is helping them developing their business and contact list. They did not participate to EXIST due to the fact that the process of applying was too complicated and they are still student working at the project part-time. They said to us that the reputation of Hohenheim University is helping them very much when they present their product mentioning the collaboration with the institution. However, they also have a lot of competitors because of the nature of the product related to the digital market.

Figure 28: Possibilities of integration of Hrm-bs screens



Source: Hrm-bs webpage

Sowa Labs, created by Ulli Spankowski in 2013, started from a research in collaboration with the European Union lasted three years and after that the members of the team decided to found a company due to the fact that they were already working very well together and the project was promising. The founder was doing his PhD at Hohenheim university and he had already experience in the financial market. The company is specialized in data analytics of unstructured and structured data. At the beginning, the team was formed by students from the IT department and Business administration and economics area and Mr Spankowski was working part-time at the company. He said that the most difficult part was the fact that they were students working part-time, hence they didn't have a lot of time and resources to develop the company. Besides, he found the support of the university very helpful with regard to the network and the contacts that his professor gave to him. He didn't find any disadvantage about working within the university, but also because they were helped not only by Hohenheim, but also by European Union.

Figure 29: Sowa Labs' logo

Source: Sowalabs' webpage

The last academic spin-off company we interviewed is Visioverdis founded by Alina Schick in 2009 when she developed a long-time plant carrying a device to let plants growth horizontally for seed greening out of roofs. She had the idea while she was studying at University of Bonn (gravitational biology and space biology) and she also cooperated with University of Firenze. During this period, she discovered a device developed 150 years ago that was trying to put sunflowers in this machine and make them growth horizontally. As a consequence, she tried to do the same with other plants and she succeeded. After that, she moved in Hohenheim and she participated to EXIST program winning the scholarship. The role of University of Hohenheim was basically helping her with infrastructures and with the mentor part represented by a professor in the university. Nowadays, she's trying with her other 2 partners to further develop the product for its future presentation in China and Dubai, where she's hoping to find new clients and opportunities. She is still at Hohenheim working at the project and sometimes they are hiring students for short periods to help them researching.

Figure 30: Visioverdis' project for the church of BW for
the 500 years of Martin Luther reformation festival in BW.

Source: Visioverdis' webpage

Finally, we had the opportunity to interview also another company which cannot be included in the academic spin-off definition. We found interesting to interview this company to better comprehend which are the difficulties for a young team to find support at Hohenheim university. The company is Empiria founded by Mark Wohler and Daniel Strober in 2011. Mr Strober, in particular, had the idea of founding this company after about 5 years from his studies at Hohenheim and after having acquired a lot of experience in the job market. Basically, they are a consulting company for insurance and banking sector and they bring some things together that there aren't in the market. They understand the whole business

model, then they bring the methods and the way a business consultant works to analyze the situation and finally they work as a media agency. Thus, whatever results comes out at the end, it is perfectly designed for the company they are working with. Before starting the company, they needed some support. So, they started to look at the different programs in Germany and they found one at University of Hohenheim. They were trying to get some space (such as office space) at the university for a good price, but the University refused them because they were too professional and their idea was too developed to give them some aid. Hence, they started the company outside the university environment due to the fact that this reaction surprised them a lot and they decided to look for support somewhere else. Now, they have some very good clients and they often participate to events concerning insurance and banking sectors, because there are a lot of opportunities for start-ups in this areas.

Table 6: Summary of the main results from the interviews

Company	Year of Founding and Product	Role of the University	Advantages	Disadvantages	Team	Scholarships or Support obtained
Geco Gardens	2013 – Gardens for balconies	Support with infrastructures and advices for business plan, marketing and sales. The university participate in the capital share.	Possibility to acquire skills; Infrastructures; Possibility to apply for support programs thanks to the student status.	Usually, the University is more focus to the prestige rather than to help for real students with their ideas.	PhD students from the Entrepreneurship department, friends and professor Kuckertz.	They did not participate to EXIST because they are working part-time. They participate at Catana Accelerator (EU Program).
OMM solutions	Digital projects	They accepted the company and organized their funding money from the German government.	Infrastructure; network; knowhow; access to young talents. The department of entrepreneurship helped in many ways or on different levels, as customer, partner and supplier.	they started as an university spin-off, but they did not get any useful support, so they founded the company separated from the university.	3 graduates, talents in the field of programming, project management and sales.	Own money + cash flow from customers.
Anders Life	2016 – virtual reality	Administration of money and infrastructures. They have a mentor.	The fact that they can apply for Governmental programs and they can use infrastructure for a cheap price.	The mentor is more focused on personal success rather than in the project. Lack of information and coordination. EXIST problem is that you need a team of students or scientists, but they need people with a lot of experience. Loss of money due to the process of buying materials through the university (a lot of bureaucracy).	3 people: one for distribution, one for production and one for development + mentor (only due to the requirement to participate at EXIST, he is a professor).	EXIST and then they want to apply for Young Innovators.
Hrm-bs	2014 - Docking station with screen	Mentoring and advising these three students.	Network of the university; contacts; pitches between start-ups; start-up environment; advices on how to present the product; offices at the	EXIST program, it wasn't explained very well or it was too difficult to participate.	6 students (one has graduated) + mentor (professor). They are all	They didn't apply for EXIST, it wasn't their objective and it was too complicated as they're still students. They invested

			university; acquire new skills; imagine of prestige when associating the product to the university.		working part-time except for the graduated one.	their money and they're using earnings to further develop the product.
Sowa Labs	2013 - data analytics	At the beginning, the university was working at the research project with the participation of the chair of IT department and his/her PhD students + PhD students from BA and Economics.	Talents from the university to hire in the company and the network with contacts and information was crucial.	People working part-time.	7 people: students from IT and from Finance + working people. At the beginning they were working also with a professor that gave them access to the network.	EU program at the beginning of the research project. Now, they are investing their own capital and they are looking for investors.
Visioverdis	2009 – device that makes plants growing horizontally	The university role is represented by the mentor and the infrastructures they can use thanks to EXIST.	Infrastructures (green house spaces) and offices. They don't have any running costs.	Lack of information and start-up culture. Too much bureaucracy and long process to buy materials (with the funds of EXIST you have to pass through the university before buying something). A lot of confusion about the steps that a company has to follow.	2 PhD students + the founder (Ms Schink) + mentor (only because it is a requirement of EXIST, he is a professor).	At the very beginning, they asked to University of Munich for some funds. Then EXIST and Young Innovators + own capital and L-bank loan.
Empiria	2011 – consultancy for insurance and banking sector	Non-academic spin off. No role of the university.	They have a lot of programs for supporting students or graduates, some start-up initiatives (bbq start-up and pitches), good entrepreneurship classes.	The requirements sometimes are too strict and difficult to achieve for participating at the programs. There is a lack of organization and information. The company didn't receive any help from Hohenheim due to unknown or not comprehensible reasons.	free-lancers and students whose want to work part-time or doing their master thesis + the founders.	At the beginning own money and now they re-invest money they earn from the projects and they are thinking about new strategies.

Source: Own Elaboration from the interviews

4.1.2. Interviews from Padova's spin-offs database

In this paragraph, we will report the main features of 16 academic spin-off from University of Padova. These interviews were made in last few years and collected in a database of the University. We took the same questions whose were asked to these companies and we conducted the interviews at University of Hohenheim. We will report the characteristics of these spin-off in a table as we did in the previous section.

Table 7: Main findings of academic spin-off from Padova University

Company	Year of Founding and Product	Role of the University	Advantages	Disadvantages	Team	Scholarships or Support obtained
Adaptica	2009 - adaptive optics application	Non-Academic Spin-off, but inspiration for the company. Now, the company is collaborating with the university and an external incubator.	Network; laboratories; Research projects looking for collaborations.	Divergences with the superiors; too much bureaucracy; no mentoring.	5 PhD and 1 post-doc (electronic and astronomy) + a lot of participations.	Personal funds; M31 incubator; entrepreneurs; a lot of refinancing.
Atemenergia	2010 – concentrated solar	Working with the National Institute of nuclear physics.	TTO's support in general was good and infrastructures.	TTO didn't help with EU projects; lack of skills and academic Staff; lack of money; too many people changing in the office, no stability; orientation to speculative research rather than productivity.	1 professor + 2 associated researchers; university; 1 apprentice; 1 PhD.	University funds; Fermi Center; National funds; EU funds; POR; regional Funds.
BMR Genomics	About 1997 – DNA sequencing	Participated spin-off from the University and the professor (mentor).	TTO's support was helpful; infrastructures.	The university is too close-minded. The professor is too interested to the prestige (he doesn't want to leave the company) instead of the productivity as the university in general. Lack of entrepreneurship culture.	University; professor; 2 IT; 2 technicians; 3 researchers.	EU – Horizon 2020; research funds from the government; clients.
Bone Promoting	2004-2006 (liquidated) - therapeutic kit for tissue healing	Participated spin-off from the University and 4 professors.	Infrastructures	Wrong selection of ideas and little support; The TTO didn't help a lot; they felt alone; no support to look for funding; no one wants to risk something.	3 post-doc; 1 technician; 4 structured professor.	Start-Cup prize, but in general it was too difficult to find funding because in Italy nobody wants to risk (the project was very risky).
BVIVA	2014 – Statistical analysis	Participated spin-off from the University.	Prestige of the University known all around Italy; possibility to access to talented students.	The university is too closed-minded and slow; the Italian System is wrong.	3 statistics; 1 lawyer; 4 psychologists of the work.	University and profits.

Engineering	2013 – Technologic solutions	Collaboration with the university with the research grant.	Infrastructures; entrepreneurship culture in progress; the TTO helped with the Start-Cup competition.	The University staff had a negative view of the company saying they were opportunists due to the use of laboratories and spaces for the company and not for the research. An obstacle was for sure that they were working part-time to the company.	All post-doc.	Start-Cup prize; Business Angels; own funds.
Fri	2009 – Tech transfer in applied research in the food field.	Participated Spin-off of the University	Confindustria meetings; Infrastructures; Laboratories; Administrative work.	Lack of skills from the academic world (very different skills found in the industry); The university managed badly the relationships with companies; Motto of the university "Publish or Perish"; need of a change of mentality.	PhD students; University and one BA (entrepreneur).	Consortiums funds; Industrial Partners; Regional Funds.
Galileia	2008 – Consultancy	2 professors were participating to the spin-off.	TTO's support was good and also the university incubator; technical skills and experience of the 2 professors; access to talented students.	The company didn't mention disadvantages, the collaboration with the university was/is very good.	7 people working in the company, one professor left and one is working for the 20% of his time.	Own funds and no other funds.
Grainit	2007 - quality control machinery in the food field	Participated Spin-off of the University.	Skills acquired during the PhD.	Lack of managerial, commercial and marketing Skills.	4 ex-students; 1 partner; university. They are working part-time.	Private funding from companies.
IT Robotics	2005 - robotics application to control systems and other industrial applications	Participated Spin-off of the University.	Access to talented students; good behaviour of the University towards the spin-off;	Lack of commercial skills; the university is more interested in research rather than productivity and selling; lack of TTO's support in finding clients or funds; no free access to scientific journals; problems with the part-time working pattern.	12 workers (also professor and post-doc).	EU programs; collaboration with companies and other universities; own funds; profits reinvested; loans from the Bank; Collaboration with

			infrastructures; very important relations between the university and the industry to stimulate research.			Confindustria.
Light Cube	2010 - led diodes for water dissipation	Participation of 2 professors.	Infrastructures.	Lack of commercial and marketing skills.	External consultants; 2 professors; 2 post-doc. They are working part-time.	Innovation Prize; Start-Cup Prize; Research Grant; investments from companies.
Nanowebfun	2009 - Skylab development of innovative materials based on polymer materials	Participation of 1 professor.	Virtual Start-Cube; University's network; world of Mouth.	University's hierarchy too closed and rigid; lack of funds; problems with the part-time work pattern.	1 Post-doc; 1 professor; 1 researcher; 1 economist.	Start-Cup prize; Innovation Prize; Industrial Partners.
Siltea	2011 – restoring cultural heritage	Advices and support, connection with the university through the research grant.	TTO's support; materials and advices; infrastructures; reference Professor's skills in advising.	The TTO's lack of skills and no support for writing the Business Plan; problems with the part-time pattern; too much bureaucracy.	3 members	Start-Cup prize; support from the BA; own funds; profits.
Sim Numerica	2010 – numerical simulation	Participation of 1 professor.	Laboratories; access to talented students; Professor's skills.	The University is too sectorialized, a spin-off is more a multidisciplinary phenomenon; difficulties in collaborations between University and Industry; difficulties in finding funds; the University's regulation of a spin-off doesn't include technicians; need of a more efficient normative; too much bureaucracy.	About 10 people between students, family members, friends, graduates.	Electrolux funds for the first project; private funds from companies.
Unired	2000 - Research in the field of cosmetics	Participated Spin-off of the University	TTO's Support;	Lack of entrepreneurship culture; problems with the part-time work	The team is composed by	Private companies and collaboration with one

			acquired skills; network of the University.	pattern.	interns and one graduate.	university in France.
Unifront – Renato Bonora	2006 - decontamination systems	The academic aspect is represented by Mr Bonora	Positive environment to growth; access to talented students.	University's Closed-minded; He thinks is not worth to give the 5% of the capital share to the University; too much focus on the academic carrier of professors; too many publications.	Renato Bonora	No problems with obtaining funds. This company finances the university.

4.2. The comparison between the two Universities

In this paragraph, we will report all the results we found out from the research. First of all, about the TTO organization in the two universities. After that, the differences about the ways to finance and support academic spin-off companies through funding programs. Finally, we will compare the main findings summarized in the previous tables. We will end-up with the conclusions about the two situations and suggesting further research on these topics aimed at finding solutions to help innovative ideas to come up from the academic world.

4.2.1. TTO

As regards the TTO in Germany, we found a very difficult situation. Before starting to interview Ms Ballesteros and asking information to the IP responsible women, we were looking at the webpage of Hohenheim University. There, we found the first problem. Hohenheim is a very multicultural environment, there are people from all over the world and the university has many collaborations with other institutions in different countries. As a consequence, not everybody speaks a fluent German. The problem was that some pages of the website are only in German, or the ones that they translated don't contain the same information. Hence, when we were trying to understand which is the regulation of an academic spin-off at Hohenheim we didn't find any information or at least not in English. We were able to find how was composed the Department, above all the staff. However, when we went to interview Ms Ballesteros, we found out that some names written on the webpage are not working anymore at the University or they have a different role. Moreover, some sections of the Uni-Hohenheim webpage were accessible only through some login password which we didn't have and we had to ask by e-mail the information that we needed. Collecting the first information to orientate ourselves in this new environment was seriously very complicated. The first impression we had was a general confused situation that Uni-Hohenheim is trying to improve. This lead us to ask, how can students, interested in founding a spin-off or developing their ideas, find the support they need if they cannot encounter in an easy way the information on the website? Usually, a website in this ages is the main tool people use to find information and to break the ice. It is simpler, after having read how does the process works, to go to the offices in person and ask for help. We found a different situation at University of

Padova. If someone is interested to find information about the TTO or the entire process of spinning-off a company, they just need to write on Google "Spin-off Padova" and they will find any kind of information or contacts translated in English. Provide information to students is the first step to develop if a university wants to create an entrepreneurship culture. As we already mentioned previously, Uni-Hohenehim didn't keep an updated database of the spin-off companies formed there. Instead of, they have this list on the webpage with a lot of names of companies only to show that the university brings success. Nevertheless, the companies in the list are not all spin-offs. Some companies were only created autonomously by ex-students after many years from the graduation. At University of Padova, there is a complete database of almost every spin-off supported by the institution and the interviews. A common obstacle, of both Universities, is that they are not developing the spin-off knowledge and entrepreneurship culture in every faculty. Several people don't know what is an academic spin-off and that there are possibilities to be supported by the university. We discovered this fact talking with some colleagues at Hohenheim and Padova and we are not talking about students of literature or faculties where there aren't classes of management, but for instance, students from Business Administration. Hence, we ask again to ourselves how can the university hope that students come up with innovative ideas if there is anyone teaching them that there is complete different world out there? Next, we had the opportunity to interview Ms Ballesteros, responsible for start-up and spin-off support at Hohenheim. She explained to us a lot of interesting things that we already reported in the third chapter and as we outlined, the situation when she started to work at Hohenheim was very disorganized. She didn't know anything about the previous workers of the TTO and how the process was managed and we didn't find any information about that. A very positive measure Ms Ballesteros wanted to implement was/is a series of workshop about the spin-off activities and funding programs to spread these information among the university. We participated to two workshops and they were very well organized and presented. However, there was only one other student participating. Thus, they didn't promote the workshop enough or students were/are just not interested to create a company. The TTO of Hohenheim is being renovated and they are hiring new people. Their aim is to construct a real support centre for creating an entrepreneurship culture and help students with their projects. They, finally, created a page on the website where it is explained everything, but this happened only when we left Hohenheim. At university of Padova, there is only one person doing everything at the TTO, so he is overwhelmed sometimes. From the interviews we read, we found out that Mr Berti, the responsible of the TTO, was very helpful in some cases and in some others not. This problem is caused from the lack of staff in the office and from the amount of bureaucracy they need to

fill. The problem of bureaucracy is typical of the public sector in Italy, but we found out that is also an impediment in Germany. The only difference is that even if at Hohenheim they also have a lot of bureaucracy, the things at the end work very well. In Italy, usually, companies keep having problems in this sense. In both universities, there are some promising initiatives to promote the spin-off and start-up culture. These initiatives are represented by pitches where only the most innovative and powerful ideas can win, or entrepreneurship institutions where students can subscribe and improve their skills such as the Start-up Garage at Hohenheim. The only obstacle is that these initiatives are not promoted enough throughout the students environment.

4.2.2. Funding Programs

In the last two chapters, we explained which are the possibilities of being financed by some government programs or regional programs. Here, we will outline which are the positive and negative facts in Italy and Germany.

First of all, Germany is very well organized and there are several opportunities for start-ups and spin-offs. The entrepreneurship culture is more developed in this country rather than in Italy. Information are spread throughout the country and universities with their TTOs. Germany is a richer country in comparison with Italy and to outline this fact we just need to look at the numbers here below.

Table 8: Higher Institution system Germany-Italy (2014-2016)

Type	**Germany**	**Italy**
N° of Universities	400	97
Staff (academic and non-academic)	675.000	153.000
Students: **Of which Internationals**	2.8 million 340.000	1.7 million 72.090
Investments in R&D in Universities	14,9 billion	6.328.700 million
N° of Spin-offs	About 38.000	About 1.380

Source: Istat (2014-2016); German Federal Government (2014); Spin-off Italia webpage (2017)

It is true that Germany spends more and has more staff also because it has more universities, but the difference is too huge to be justified only by this reason. There is a complete different management of the funds for higher education. In particular, we can also notice this gap, when we look at the prizes of national funding programs. EXIST for start-ups offers to the winner about 3.000 € per month plus 150€ per month for childcare and in one year they offer up to 30.000 € for materials and 5.000 € for coaching. EXIST for research arrives to the sum of 250.000 in total. The National Innovation Prize in Italy gets up to 25.000 € in total, not per month. Young Innovator, the regional program of BW, gives 20.000 € plus 5.500 for coaching in total and the usage of infrastructures of the university for free. The similar regional program in Veneto, Start-Cup, offers up to 20.000 € and they also have to pay infrastructures such as laboratories of the university if they need them. Therefore, the funds in Germany are higher and they support also families and coaching. This is an enormous gap between the two countries which gives light to the fact that the Italian government is not investing enough in higher education institutions.

However, even if in Germany academic spin-off companies have more opportunities rather than in Italy, it does not mean that these programs work perfectly. During the interviews to Hohenheim spin-off, we notice a frequent problem. EXIST program, especially, requires the presence of a mentor who usually is a professor and the money they offer for materials are administrated by the university which also is in charge of researching in the market the best prices and buying the materials. This implies a very long bureaucratic process that makes companies losing a lot of time and money. Besides, 2 companies we interviewed stated that they didn't like the fact of "hiring" a professor as a mentor because they don't need his/her skills, but rather an entrepreneur with more experience to support them through the process. EXIST program helped a lot of companies in these years, but still there is the need for further research about the consequences of participating to show if it would be more efficient if the team could chose by itself how to buy materials or who is going to be the mentor. In Italy, the fact that there are these opportunities of being financed is not enough. We have to ask to ourselves, how can really survive an academic spin-off with a total financing of 20.000 in one year? Are there other measures to implement after the first year? If so, which are these ways? Why is it so difficult for Italian spin-off companies to find investors or win other scholarships/financings? We think that there is much more to explore and implement in the Italian higher education system, because it seems that after winning the Start-Cup prize these companies are left alone. Several Padova spin-offs said that the TTO didn't help to find investors or guide them to new measure to apply for.

4.2.3. Academic spin-off companies

We summarized the main findings of the various interviews to the Hohenheim and Padova spin-off companies and we found some similarities and differences. The main difference between the two universities is the presence of the TTO. At Hohenheim, none of the companies we interviewed mentioned the utility of a TTO or if they were helped by it. The main reason was that there wasn't an organized TTO and if there was, nobody knew the existence of it. Only in the last few months, Hohenheim university was creating a stronger network and hiring new people in the TTO to support spin-offs and start-ups. Instead, at Padova there is a good TTO, but the main problem we found is that there is only one responsible that is managing different areas of the spin-off process. As a consequence, this person is overwhelmed by the amount of work that there is beneath. In fact, some Padova spin-offs stated that they felt alone after being founded because there is no one helping them to find clients and investors, so supporting them in the commercial activities. A common obstacle to the spin-off environment is the amount of bureaucracy which is the peculiar characteristic of the public sector in both countries. Besides, a deep gap between the two universities is that at Hohenheim is easier to find financings and investors, while at Padova it isn't and spin-offs must also pay for the spaces they are using at the university. We found also that both universities are interested more in the prestige, for instance through publications, instead of really promoting productivity. Nevertheless, this negative fact seems to be stronger in Padova. Among the advantages which both spin-offs outlined, there is the access to talented students from the university to hire when the company has the need of interns or for some specific project. Another difference between the two spin-off environments is that at Hohenheim they don't have all the faculty whose are present in Padova. One PhD student from the Entrepreneurship Department at Hohenheim told us that the main problem is that they have a lot of students from agriculture and management faculty, but no one that is able to codify. They don't have engineers as in Padova university, so they have a lot of ideas at the entrepreneurship department, but anybody able to implement them.

Moreover, the part-time working of the members of these companies influence negatively the progresses of the spin-offs in both universities. In fact, people employed in the academic spin-off company are often working part-time due to the fact that they are also students, professors, researchers, PhD. Subsequently, they are not focus only to growth the company. The Teams in both universities are formed by PhD students, for the majority of the cases, plus some mentors which are usually professors that have to balance also their academic job. One other

common disadvantage encountered is the lack of skills and knowledge from both the professors and the members of the spin-off and the academic environment in general. In particular, this is caused by the fact that members of a spin-off are academics and not entrepreneurs. They are used to study and research, not to sell and plan marketing campaigns. They also don't have time to acquire these skills due to their life between the academic job and the company. In some cases, both in Hohenheim and Padova, professors' experience in the field helped a lot developing the company. Nevertheless, in some others, they didn't help, but they thwarted the process due to different views for the success of the company. Generally, the university environment is seen as a good place where to take advantage of infrastructures, laboratories, but most importantly of the network they already have. In a lot of cases, in both countries, these spin-off companies benefited from the contacts that the university provided to expand and spread their product or service.

CONCLUSION

This dissertation has aimed to respond to the following research questions. First of all, it has intended to assess how Italy and Germany ensure the reinforcement of the academic spin-off environment through governmental and regional funding programs and incentives. Secondly, it has explored the key characters in place in Italy and Germany such as the number of employees in the academic area and the typology of students, the TTOs in the universities, the budget of the two countries for R&D in this field and the academic spin-off's growth trend. Finally, this dissertation has focused on the similarities and differences between the two countries, especially within Baden-Württemberg and Veneto regions outlining the main features of Hohenheim and Padova universities. Furthermore, a practical case with seven interviews from Hohenheim and 16 from Padova is analysed to discover the obstacles and benefits which spin-off companies have to face in these two opposite realities.

In order to fully answer these research questions, it has been necessary to begin with the international and European literature framework concerning the development and characteristics of academic spin-offs, to pass afterwards to the analysis of German and Italian university spin-offs companies. The most important researches have been analysed such as Vohora et al. (2004), Clarysse and Moray (2004), Lockett and Wright (2005) and so on. Reference has been made to the common definitions of academic spin-off, venture capitalist and business angel consulting relevant authors and the International Association of Science Parks and Areas of Innovation. Some crucial initiatives of the German Federal Government and Italian Government have been described, such as EXIST, Young Innovators, Start-Cup and PNI (National Prize for Innovation).

From the analysis of the literature frameworks, it emerged that there is no common agreement or unique legislation on the processes regarding the protection of academic spin-off companies. Even the definition of this phenomenon is heterogeneous across European Members States or within regions of the same country. As a result, there are very different laws and practices concerning the support offered to these companies. As a consequence, all these processes are ruled and approached differently in the two countries of interest. Particularly, several shortcomings surrounding these practices, as highlighted in the latter part of this study, need to be acknowledged and addressed by both Italy and Germany in order to create a fair system of support which sustain the development of academic spin-off companies.

With regard to the situation analysed through the interviews, the study demonstrates that there are some huge differences between an innovative nation as Germany and a traditional country as Italy. The study found that in Germany there are several governmental aids for academic spin-off companies which provide support from the seed phase to the after-start-up step and also for materials and family expenses. It is clear how Germany has a solid view about how things must be made and how they should stimulate young people to spread their ideas. It emerged that Germany has much more resources to invest in the higher education system, especially in R&D. Moreover, Germany contains a bigger number of universities and, as a consequence, staff that work in the different institutions. However, the study shows how Italy is also similar to Germany in the sense that it is investing more in R&D and it is designing new governmental and regional support programs for start-ups and academic spin-offs to reach the European average level. As in Germany, there are some universities which produced several spin-offs in the past years and which are very efficient in their procedures and infrastructures. However, there are also some common problems as we discussed in latter part of the study. Hohenheim university is still at the beginning of the creation of a strong process to spin-off promising companies. This university seems to highlight various negative aspects which are present also in Italian universities, in particular in Padova. The study evidences that Hohenheim's TTO need to do some huge improvements to get in touch with students and researchers who are interested in creating a company, while in Padova there is an apparent need of hiring people to manage efficiently the support process. Often, they lack of commercial and marketing skills or sufficient and precise information about the possibilities to finance these companies. Members of spin-off companies, interviewed both in Germany and Italy, felt alone most of the times due to the fact that they had to find out everything by themselves or they didn't know to who to talk with. Researchers and students, but also the TTO, when present, are not appropriately trained and are often not fully aware of the individual needs of the team and the company in general.

Among the most significant advantages, of creating a company within the academic world, there is the fact that members of spin-off companies can obtain talented students to help them in different periods through internships and they can access to the university deep network with the industry sector.

Finally, the presence of a professor as a mentor or the participation of the University in the capital share of the spin-off company are not always a positive aspect. In some cases, spin-offs gained skills from the experiences and advices of the mentor, but in some others it was a real impediment for the progresses of the firm due to different goals among the team and the academic area.

It is evident from these findings that there are clear gaps between Germany and Italy. However, in the specific cases we analysed we found more similarities between the two universities instead of differences. In order to facilitate the fulfilment of their objectives, these two universities should improve the organization of their TTOs, hiring qualified people who will follow new born companies from the very first step to the final phase where, usually, spin-off companies need new finances and commercial/marketing advices. In the case of Hohenheim university, the members of the Research and entrepreneurship department should promote more their activities because a lot of students and researchers we interviewed didn't know anything about the presence of the TTO or they found out by themselves ways to finance their companies or use infrastructures of the university. On the other hand, in Padova, the TTO should hire people who will work in the office permanently following the different areas in an efficient way from the fieldwork of new funding programs, to the support tasks during the commercial activities. On the other side, members of spin-off companies, in particular the Padova ones, should project the start of a spin-off company in a better way. Often, members of Padova spin-offs are students or researchers whose don't know how to write a business plan or where to find clients and so on. Before starting a company, they should do a better market research and ask for support in these tasks to people who studied these subjects or worked in the field. Spin-offs of Hohenheim where very good in this sense, they were collaborating with people who were/are experts in the areas where the founders lacked of competences. Additionally, governments must ensure funding programs after the spin-off's first year of life due to the fact that the funds are not enough for the further development of these high-tech products and the only way to make progress in this changing economy is to finance the right innovative projects. Effective mechanisms for family and materials should be improved in Italy, where spin-offs company must pay for infrastructures even if they have won the scholarships and these programs don't provide any help to whom has also a family as Germany does. From the interviews, it is clear that the university environment is ruined from bureaucracy and this aspect is affecting also the spin-off process. Universities should streamline their procedures, for instance in Hohenheim when they have to buy materials they should collaborate more with the members of the spin-off or let them do the market research because they know more about what the company need to develop the product/service. In Padova, the university should provide spaces and laboratories for free as Hohenheim already does.

Besides, there should be a common regulation of academic spin-off in Europe or at least an ordinary definition. There is still a lot of confusion and misunderstanding on this argument at European Level in relation to the U.S. where the phenomenon born. This lead universities to

apply very different rules and government to design too strict financing programs. There should be more efforts at European level to create the "Spin-off Culture" and to support more the nations which don't have as much funds as the rich ones (Germany, U.K., Belgium and so on). Afterwards, in this study is evident how the lack of information of Hohenheim influenced the analysis. Hence, every university, which is promoting or has the wish to spread the entrepreneurial culture, should keep a database about the business cases supported in the previous years and update their webpage to make easier to people who are interested in the field to find information. The huge common problem in both university is the share of the information about financing programs and the steps to follow to create a solid company. Thus, knowledge is the basis to begin every process. The lack in Hohenheim of action and implementation of official measures is leading to increased vulnerability of its spin-offs companies. Therefore, there is urgent need to implement existing national legislation more thoroughly, and raise national practices and standards in order to fulfil the needs of academic spin-off companies both in Germany and Italy. Certainly, States have the obligation to identify the right steps that must be undertaken to improve the system of support and improvement of the entrepreneurship culture in the higher education institutions.

An initial step, as we already mentioned, could be the unification and harmonization of the standard procedures for the protection of spin-off companies not only in Italy and Germany, but at the European level. For instance, European Union should provide a special section on the webpage about only academic spin-off companies and the different possibilities and programs they have in Europe. Next, German governmental programs should be more flexible, such as EXIST. In different interviews, we noticed that spin-off companies can only participate to the program if they are a team of three people with one professor. Some of the people we interviewed found this requirement not very intelligent because it is impossible to work to a high-tech product only with three people and the only choice of a professor as a mentor. In Italy, the most important lack in the system is the support after winning the Start-Cup competition. Padova spin-offs are simply left alone and they have to find new ways of financing by themselves without any support from the university, which is still participating in the capital share. Padova University should also have a specific regulation of when the university or the professor must leave the company. It should be written the maximum amount of years or which are the possibilities to participate or leaving from the spin-off company. In fact, often, professors want to stay as much as possible in the company to earn prestige and money working only the 20% of their time and they usually have more academic goals for the firm instead of managerial or commercial objectives.

The destiny of this discussed issue is uncertain and it is difficult to foresee and evaluate what will happen in the next years. With regards to Hohenheim spin-offs, we saw good improvements in the university and the TTO. They were starting an efficient process of hiring qualified people and organizing workshop to spread information about support programs. Hohenheim university can only have improvements from now thanks to the efforts they are putting in developing an entrepreneurship culture. As regards Padova, the spin-off culture is older than that of Hohenheim, but still in the interviews we have observed the same problems in the time-period from 2000 to 2014. As a consequence, if Padova spin-offs are dealing with the same disadvantages of year 2000, it means that there is a visible need of change.

However, one of the critical issues emerged is that after three years, many spin offs do not survive after leaving the university incubator (Neri, Ciullo, Giovagnoli, Giarnieri, 2014). Among the possible causes is the theoretical approach the University has with technology transfer. The transition to the industrialization phase of research ideas is indeed difficult for the University.

Managers and researchers responsible for start-up and spin-offs need to present to the market with concrete ideas and marketable ideas by targeting well defined and achievable projects. To do this, an entrepreneurial culture is needed which should be present during their studies as early as the high school. In addition, university offices should be more fully implemented by the spin-off offices, dedicated to technology transfer activities.

Moreover, Italy has to cope with an economic crisis and therefore has limited resources to guarantee the proper support to new companies, especially spin-offs which have a high risk. Nevertheless, Italy is trying to respond positively to this challenge and it has made a very significant step forward with all the researches which have been conducted in these years and the development of TTOs and regulations in each university.

Lastly, it is fundamental to understand the academic spin-off phenomenon due to the fact that concern young people with innovative idea, as a consequence, the future of the Country's economy.

It should also be stressed that there is the requirement to further research in this field, because the literature is still very confused with several opinions about the convenience of university spin-offs.

Importantly, every EU member state should keep an updated database of spin-offs and clear information about the processes and the funding programs.

We advise further investigation about the TTO influence in the process of spinning-off a company and in which ways Italian universities can improve the entrepreneurship culture, above all the commercial skills through professors, researchers, students and staff members.

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