

# THE GROWTH OF HIGH TECH ACADEMIC SPIN-OFFS AND THE ROLE OF THE PARENT ORGANIZATION: THE CASE STUDY OF UNIVERSITY OF TURIN

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## 1. Introduction

Entrepreneurial scholars worldwide are more and more involved in investigating academic spin-offs since these ventures can be the driver through which policy makers can foster economic and social development. Academic spin-offs are a particular type of spin-off companies created with the aim of exploiting on the market the results of academic research (Pirnay et al., 2003). In addition, these companies are founded by academic people (professors, PhD's, students) and benefit from a direct transfer of knowledge from the university. The level of involvement of key academics in the new companies may vary giving rise to different types of spin-offs (Nicolaou and Birley, 2002). Despite their heterogeneity, academic spin-offs are supposed to be one of the most powerful means of technology transfer (Philpot et al., 2011) as the new technologies are exploited leveraging on a new venture which is established with the precise aim to extract value from them.

The number of academic spin-offs has significantly increased in all developed economies in the last twenty years. Virtually each university is investing resources in promoting and supporting spin-off generation providing several services and activities such as programs for improving entrepreneurial capabilities of founders, mentoring, networking, access to venture capital funding, IP protection services, business development. Most of these activities are usually employed by Technology Transfer Offices (TTOs) together with central university incubators, if present. Ultimately, universities of origin act as parent organizations for academic spin-offs.

While numerous, academic spin-offs do not seem to reach good performance in terms of growth. With regard to EU, Mustar et al. (2007) have shown that many spin-offs remain small sized as 80% of survived academic spin-offs employ less than 10 people after six years of existence. Similar evidence has been founded in Italy where only a small portion of the population of academic spin-off (more than 1.100 as of the end of 2014) shows significantly post-entry growth trajectories and get venture capital financ-

ing (Netval, 2015). Thus, the issue of academic spin-off ability to grow is of considerable interest.

While an extensive literature has focused on sources and determinants of academic spin-off creation (e.g. Di Gregorio and Shane 2003; Lockett et al. 2003; Rothaermel et al. 2007; Djokovic and Souitaris 2008; Walter et al., 2006; O'Shea et al. 2008), surprisingly few authors have addressed the issue of the post-entry growth of these ventures (van Geenhuizen and Soetanto, 2009; Wennberg et al., 2011; Clarysse et al., 2011b). This paper tries to fill this gap by investigating the academic spin-off growth process and by focusing on resources and capabilities that allow these spin-offs to grow after their birth. Grounded into the Resource Based Theory of the firm, the paper aims to analyze the role of the resources provided by university of origin in the spin-off development process. In particular the research investigates the influence on academic spin-off post-entry growth of three different types of university resources: technology transfer office (TTO), university brand and incubator presence. The focus on university of origin resources is directly linked to the fact that academic spin-offs are by nature in short of critical resources – these companies come from non-commercial environments, are promoted by people with scientific backgrounds and typically lack management and entrepreneurial capabilities and skills. Adopting a phase-based process of early growth, this paper investigates how the three cited university of origin resources (TTO, brand and incubator) can contribute to overcome the various obstacles that impede academic spin-off to reach the next development phase and therefore to grow.

The paper derives from a research on high tech academic spin-offs that is at an explorative stage. Coherently, the paper leverages on a qualitative approach based on the case study methodology. Four academic spin-offs created in a major Italian University (University of Turin) and already on the market have been deeply analyzed. The choice of focusing on a single university in investigating academic spin-offs is in line with several previous studies (Gübeli and Doloreux, 2005; McAdam and Marlow, 2008; van Geenhuizen and Soetanto, 2009) that have chosen one university in their empirical settings. The paper is structured as follows. Section two provides a literature review focusing on previous studies that have tried to link the three cited university of origin resources and the spin-offs' growth. Section three proposes the research framework and formulates the general assumptions which drive the empirical analysis. While section four describes the methodology adopted, section five provides details on the empirical analysis and results obtained. Section six discusses the results and identifies managerial implications for universities wishing to improve the growth performance of their spin-offs. Conclusions are reported in section seven while limitations of the paper and suggestions for future research are offered in the last section.

*Despite the paper is the result of the strong cooperation among the three authors, Elena Candelo wrote sections 2, 3, 4, 5 and 6, Mario Sorrentino wrote section 1 and 7, and Valter Cantino wrote section 8.*

## **2. Literature review**

In adherence with the resource-based views, firms are bundles of resources which can be developed or acquired in order to generate revenues and wealth (Barney, 2006). In these views, resources on which a firm leverages to grow and generate wealth must be rare, valuable and non-imitable (Wernerfelt, 1984; Barney, 1991). In the case of academic spin-offs, critical resources are usually missing given the very nature of these companies. They stem from a non-commercial environment (e.g., university departments) where promoters have a scientific background and very seldom have previous entrepreneurial experience. This means that important resources for managing a new high tech academic venture – such as management and marketing knowledge and skills, entrepreneurial capacity (Clarysse et al., 2011a), business relationships with critical stakeholders including angel investors and venture capitalists – are missing. As a matter of fact, academic spin-offs not only need these critical resources, but they also need capabilities in order to develop and/or access these resources with the final goal of overcoming the obstacles that impede them to grow.

In this context, the university of origin plays the role of an incubator organization (Cooper, 1985) which may act as a direct supplier of critical resources at low costs (Rothaermel and Thursby, 2005). In fact, in their growing efforts to promote academic entrepreneurship, universities provide several supporting activities which all have the aim of supplying lacking resources or facilitating the access to them. In doing this, supporting activities offered by universities should have the underlying goal to develop the needed capabilities in utilizing and/or accessing these resources besides simply providing them. Obviously, focusing on the resources provided by the university of origin straightforward recalls resource-based views of the firm.

Universities supporting programs for stimulating academic entrepreneurship are not standardized as the format of these programs does vary across universities. Universities may adopt different policies to encourage academics to create ventures or to help them in recognizing opportunities, launching the company, gaining the first customers and accessing risk capital. While differentiation of activities stands, evidence suggests that there are at least three types of resources that universities employ to stimulate academic spin-offs. The first type is university Technology Transfer Offices (TTOs) which invariably are set up, organized and staffed in order to support academic entrepreneurship providing specialized services. Literature has extensively analyzed the role of university TTOs in driving academics to start new ventures. Several studies have underlined the contribution of TTOs to the creation of academic spin-off companies (Carlsson and Fridh, 2002; Siegel et al., 2007). In this direction, O'Shea et al. (2005) and Markman et al. (2005) found that academic entrepreneurship was positively corre-

lated with the number of TTO employees and the years of TTO experience (see also Gomez Gras et al. 2008 on the latter). A different finding has been obtained by Lockett and Wright (2005) who showed that academic spin-off creation was mainly linked to the business development capabilities and expertise of technology transfer staff rather than to the number of years of involvement with technology transfer. With regard to Italy, previous studies conducted in the beginning of the millennium (Piccaluga and Balderi, 2006) showed that TTOs were often inadequate as the background of their employees is more oriented to administration rather than to management of technology. According to Muscio (2010), TTOs with a longer experience seem to be just as efficient as newer ones. Algieri et al. (2013) found that TTOs' budget and number of qualified employees positively influence the creation of academic spin-off while this was not the case for the age of these offices. Iacobucci et al. (2014) have recently shown that Italian academics are being involved in starting spin-offs even when the university TTO has not been established yet.

Even if questioned, the role of university TTOs in promoting and supporting academic spin-offs needs to be carefully analyzed. This is particularly true in a country like Italy where the phenomenon of academic spin-offs is quite recent as compared to both US and EU. The literature review has shown that while scholars have diffusely investigated the impact of TTOs activity on the *birth* of academic spin-offs, no studies (to our knowledge) have analyzed how these offices facilitate their *growth*. From this angle, it can be for example hypothesized that the efficacy of role of TTOs may vary according to the stage of development of the spin-off or it can be assumed that these offices should be involved in offering selected activities only (e.g., IP protection) rather than in supporting the whole development process of the spin-offs companies.

Another important resource that universities very frequently employ to promote and support academic spin-offs are incubators (Rasmussen et al., 2011; Clarysse et al., 2005; Lockett et al., 2005). Generally located in central buildings, university incubators are at the core of virtually each university that aims to foster technology transfer and economic valorization of academic research. Even if incubation strategies can differ (Clarysse et al., 2005), i.e. different services can be supplied to aspiring entrepreneurs in reference to different contexts, it is unquestionable that incubators can offer dedicated services that can reduce the existing gap between aspiring entrepreneurs (who have an academic background) and the market (Mian, 1996).

Given the nature of the services provided, academic incubators are supposed to positively influence the growth of the spin-offs they host. High value-added services such as networking, access to venture capital, managerial consultancy and business development in fact provide access to

critical resources on which the spin-offs can leverage to grow. Soetanto and Jack (2016) found that incubation support in the form of networking and entrepreneurial support has a positive effect on the performance of academic spin-offs in terms of sales, profit and market share. Academic incubators do contribute to build university networks which have a positive influence on the ability of spin-offs to attract external funding for research and innovation (Soetanto and van Geenhuizen, 2015). At the same time, high value-added services offered by incubators have the underlying function of developing entrepreneurial capabilities of the founders – this seems actually to be the most important role of incubators. Thus, depending on the capabilities and expertise of their management staff, university incubators should be able to directly impact on the growth of academic spin-offs. However, this seems not to be the case as many of the worldwide non-growing academic spin-offs are hosted in university incubators. Thus, as well as told for TTOs, the role of university incubators in supporting academic spin-offs also needs to be carefully analyzed with the aim of detecting how these organizations can really impact on the growth of spin-offs.

While TTOs and incubators are deliberately employed by universities in order to promote and support spin-offs, university brand is a corporate asset that doesn't need to be mobilized. In general terms, an effective university brand influences the ability to attract the best students, researchers and professors, to increase alumni association membership, to attract funds and donations, to improve research projects and publication - it seems also to have an indirect impact on support for arts and athletic programs (Judson et al, 2008). University brand is a strong asset to implement and use, just like a corporate asset. But a question arises: what makes a university brand so strong?

According to Aaker (2004), the corporate brand success is determined by a set of requirements: the successful track record, the specialization, the ability to innovate and to adapt to today times, the brand capacity to create value for stakeholders, the necessary resources to implement brand strategies, the professional skills of people working in the organization, the product quality, the attitude to consider the customer as a top priority, the values pursued by the company towards stakeholders.

University brand is supposed to support academic spin-offs because of its external positive reputation. In particular, it can be assumed that the lack of legitimacy of an academic spin-offs (like that of all start-up firms) (Uberbacher, 2014) can be reduced by university brand leveraging on the university certification function (Akerlof, 1970). Indeed critical stakeholders seems not to be able, at the very beginning, to evaluate the quality of a university spin off. However, they may rely on the reputation of the university, whose name works as a true brand. Thus, the positive perception of the university brand is reflected into academic spin offs and should be able to help them in overcoming important obstacles to their development:

the lack of credibility, the absence of reputation, the shortage of consideration (e.g. by potential customers) – that is, university brand should be capable of reducing the spin-off liability of newness (Stinchcombe, 1965). In addition, university brand can be a lever to be used to attract potential end users, where present, as the latter may be induced to buy spin-off products and services because by doing this they can enjoy university image.

Given the above, the goal of this analysis should be twofold: providing insights on the role that universities of origin should have in order to facilitate the growth of the spin-off companies and assuring that the investments made by universities for promoting spin-offs are efficient.

### **3. Framework of research**

As evidence shows, several are the factors that can cause a spin-off to stop growing and to enter a steady phase. One fruitful way to investigate the difficulties of growing of academic spin-off is to focus on the obstacles to growth they encounter in their different, subsequent phases of development. In the model proposed by Vohora et al. (2004), and subsequently adopted by other scholars (van Geenhuizen and Soetanto, 2009), spin-off firms follow various stages and face critical junctures in terms of resources needed in order to reach next growth stage. These junctures are *opportunity recognition*, *entrepreneurial commitment*, *credibility* and *sustainability*. As we will see shortly, junctures may refer to poor or non-availability of critical resources or to the lack of capabilities needed to gain and access to these resources.

*Opportunity recognition* refers to the difficulty founders face to clearly identify the entrepreneurial opportunity that derives from the results of academic research done. One of the key issues in the process of opportunity identification is the ability to foresee realistic industrial applications of the new technology. This is not easy as spin-off founders generally have a scientific background and lack interactions with industrial stakeholders. Evidence shows that academics who have had in their career relations with firms are better equipped to foresee potential industrial applications of their research. These researchers – usually a small portion of all university professors - have a kind of “commercial mindset” that allows them to proceed in their research stream while looking at potential industrial needs. Very often these academics also show networking capabilities that allow them to fruitfully interact with industrial partners (Walter et al., 2006)

*Entrepreneurial commitment* juncture denotes situations in which academic founders are not sufficiently committed to manage the start up of the new company. This lack of commitment refers to motivational, financial and human capital deficiencies that practically impede the academic

entrepreneur to invest resources and create the company. Motivational deficiencies are mainly due to the fact that academic scientists are self-selected towards risk-averse forms of employment (e.g. becoming a professor) while it is well known that starting a new venture requires risk-taking aptitude and behaviors (see among others Brockhaus, 1980). This risk-aversion profile tends to emerge when academic founders are asked to make initial investments in order to proceed with the start up of the company - these investments are not only financial but also in terms of personal time devoted to the spin-off. Lack of entrepreneurial commitment also derives from human capital deficiencies of academic founders. While they may be considered as "star scientist" (Zucker et al., 2002, Torero et al., 2001), most academic founders do not have managerial skills and previous entrepreneurial experiences - very often they feel uncomfortable when dealing with business operational tasks.

*Credibility* juncture refers to the difficulties academic spin-offs face in accessing critical start up resources from stakeholders. Potential customers, financial investors, new management partners, suppliers, all of them are prevented from interacting with the new spin-offs because the latter lack credibility on the market. This basically happens because academic spin-offs do not have tangible resources, lack reliability (Sohl, 2003) and are perceived as very high-risk ventures. While typical of new ventures, this perception is enhanced by the fact that academic spin-offs stem from non-commercial environments and are promoted by people with scientific backgrounds who typically lack management and entrepreneurial capabilities. Thus, gaining credibility on the market is of paramount importance for academic spin-offs as credibility reduces the liability of newness (Stinchcombe, 1965) which impedes them to grow. Again, a central role in the acquisition of credibility is played by the networking capability of academic founders (Shane and Stuart, 2002; Walter et al., 2006) – the capability of establishing and perpetuating transactions with critical stakeholders.

The fourth juncture in the model proposed by Vohora et al. (2004) is *sustainability*. This obstacle is related to difficulties in reaching a sustainability threshold once the spin-off has entered the market – this basically means the acquisition of sustainable returns for the spin-off. Both the ability to reconfigure resources and products according to market feedbacks and the ability to obtain economic returns from the start up investment are crucial to reach the sustainability threshold. These abilities are both mainly related to management and organizational capabilities of the founders. Proxies of these capabilities are the introduction of delegation of activities to employees, the clear articulation of roles in the founding team (Grandi and Grimaldi, 2003), the use of organization charts and the implementation of management practices. If the spin-off does not reach the sustainability threshold it cannot grow or even just survive even if market and technical

feedbacks are positive. In fact, initial resource endowment is progressively eroded, and the spin-off tends to stagnate after its first years of existence (thus suffering from what has been defined the liability of adolescence) (Bruderl and Schussler, 1990; Fichman and Levinthal, 1991).

In the remaining of this paper we employ the model proposed by Vohora et al. (2004) in order to investigate how university of origin resources can drive academic spin-offs to grow by overcoming the cited four junctures. The literature review conducted in the previous section has shown that studies on the role of TTOs, university brand and incubators in favoring the post-entry growth of academic spin-offs are rare – they do not seem to provide robust evidence on the way these resources do influence spin-offs' growth. Adopting the Vohora et al (2004) stage-based model of growth of academic spin-offs, we make the assumption that selected resources provided by university of origin can contribute to overcome the four critical junctures along the development phases – this should allow the spin-off to grow. In short, in order to detect the link between university of origin resources and the growth of academic spinoffs the research framework poses three research questions: a) is university of origin providing critical resources needed to overcome the junctures? b) is the university of origin developing promoters' capabilities needed to access critical resources? c) are university of origin resources equally relevant in facing the single critical junctures? These three basic questions have driven the empirical part of this study.

#### **4. Methodology**

In order to investigate the influence that TTOs, brand and university incubators have on academic spin-off development, we use the case study method (Eisenhardt, 1989; Yin, 1984). Even if we are aware that in the managerial disciplines there is still a predominance of quantitative methods (Lee et al., 2007), we decided to conduct a qualitative analysis – based on multiple case studies – since it seems to fit better with our research aim. As anticipated, in fact, we try to investigate how some independent variables (that is, the resources provided by university of origin) affect the dependent one (spin-offs' ability to overcome obstacles and grow) (Edmondson and McManus 2007).

A very interesting point that needs to be clarified deals with the number of cases to consider. As noted by Eisenhardt (1989, pg 545): *“while there is no ideal number of cases, a number between four and ten cases usually works well. With fewer than four cases, it is often difficult to generate theory with much complexity, and its empirical grounding is likely to be unconvincing ... with more than ten cases, it quickly becomes difficult to cope with the complexity and volume of*

*data*". Eisenhardt's proposal has created a lot of interest in this topic and different views have been proposed. On the one hand, Dyer and Wilkins (1991) have supported the idea that even a single case study can be sufficient. On the other hand, Yin (1984) has underlined that addition of new cases needs to be stopped if meaningful new data cannot be derived from them.

In line with the original perspective proposed by Eisenhardt (1989), the present study concentrates on four cases of academic spin-offs stemming from the University of Turin (Italy). Four in-depth on-site interviews with spin-offs' founders were conducted by the authors. On average, face-to-face interviews lasted 1,5 hours and were based on open questions aimed at understand the rise and disappearance of obstacles in different phases of spin-off development and the role of university of origin resources in overcoming or preventing these obstacles. Additional data were obtained by investigating companies' and university incubator web sites. Direct interviews with university incubator's manager and TTO's representatives were also conducted. Definitively, we used a longitudinal perspective based on present spin-offs looking back into their past – that is, we used a retrospective analysis.

Italian Piedmont Region chief town, Turin has a positive and proactive attitude towards the support and development of young innovative firms. Turin hosts two university incubators (University and Polytechnic) and two science parks (Environmental Park and Bio\_Industry Park), which prove the interest of Piedmont Region in developing technology transfer processes and spin-off creation. Moreover Piedmont is in top three Italian Regions, with Lombardy and Lazio, for R&D expenses (Salvador, 2011) and it's characterized by a strong specialization in aerospace, ICT, automotive, and transports. Founded in 1404, University of Turin – with its 26 Departments – is a large generalist university. Currently it ranks in the very first places in the country due to a vigorous process of internationalization and a constant attention to research and teaching. Cesaroni and Piccaluga (2015) have recently shown that University of Turin shows the highest value of knowledge transfer activities also thanks to its longer-lasting experience in this activity. Thus, both the positive track record of spin-offs' creation and the importance given to the exploitation of scientific results make University of Turin a good candidate for the analysis.

## **5. Empirical analysis and results**

University of Turin's promotion of academic spin-offs leverages on both TTO and university incubator. Operative from 2009, university TTO currently employs 3 full-time persons. The activity of this office has mainly been focused on supporting academics in the administrative spin-off authorization process while other typical activities – such as patenting assistance, scouting, technology transfer processes, business plan development and management training – have been mainly offered by university incubator's staff. As we will see later in the paper, this limited role of TTO will influence some of the results of the study.

The university incubator has been launched in 2007. It is managed by a limited consortium - 2i3T – that University of Turin has created together with two local authorities (City of Turin and Province of Turin) and a regional financial agency (FinPiemonte Inc.). Hosted companies can be located in the incubator up to three years.

At the time of the interviews, 39 spin-offs companies were located inside the incubator.

Exhibit 1 shows some information on the four case studies. Three reasons have conducted to select these ventures among the 39 spin-offs hosted in the incubator. We selected spin-offs which were already on the market, aged at least three years and operating in high tech industries. While the first two reasons were necessary in order to investigate the sustainability juncture, the third reason lies in the fact that this explorative research is part of a wider study on high tech academic spin-offs. Among the spin-offs which targeted these criteria, we selected the four cases that the incubator's manager considered the most meaningful from the point of view of the incubator. No suggestions in selecting the spin-offs were provided by TTO representatives as this office – as just mentioned – is mainly focused on the spin-off authorization process.

Year of first sales has been considered the year of actual birth of the spin-offs – companies' age ranges between 3 and 6. Three out of the four companies have been previously located (De.Tec.Tor) or are currently located (AgriNewTech and Biosfered) in the university incubator – one company only (Sinbit) has been tutored and supported by the incubator without being located inside it (spin-off location is inside a university department in this case). In terms of growth, while De.Tec.Tor can be considered the most growing spin-off, employing 11 people and reaching sales for 1 million euros, both AgriNewTech and Biosfere have reached satisfactory performance (2015 forecasts for the latter indicate sales of around 900k euros and a significant increase in the number of employees). Poorer performance in terms of growth are obtained by Sinbit – this is the only spin-off which has not faced the sustainability juncture yet.

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*Exhibit 1 – Basic information on the four analyzed academic spin-offs*

<b>Spin-off name and business</b>	<b>Age</b>	<b>Interview with</b>	<b>Full-time employees</b>	<b>Sales (2014/euros)</b>
<i>AgriNewTech</i> Services and products for the protection of agro-environmental resources, the increase of food safety and food security, through the use of biotechnology	6	Founder and CEO	5	485k
<i>Biosfered</i> Production of plant extracts for pharmaceutical, food and dietary supplements, cosmetics and feed industries.	3	Founder and R&D Director	4	250k
<i>De.Tec.Tor</i> Design and production of high precision particle detectors for on-line beam monitoring and daily quality assurance used by <i>hadron-therapy centres</i> .	5	Founder and CEO	11	1M
<i>Sinbit</i> Development of smartphone and tablet applications for big events.	3	Founder	3	60k

In order to recognize the strength and the representativeness of the matching between university of origin resources (TTO, incubator and brand) and the four critical junctures (opportunity recognition, entrepreneurial commitment, credibility acquisition and sustainability) faced by academic spin-offs, we propose a set of measurable variables (Exhibit 2). These variables have been observed from the point of view of both the spin-off and the university of origin - their measurement allows to assess and comprehend the level of impact of the specific resources on the single spin-off and to make comparisons among different spin-offs.

*Exhibit 2 – Variables used in measuring resource/junctures matching*

<b>Junctures</b>	<b>Variables</b>
<i>Opportunity recognition</i>	Identification of business idea (IBI)
	Foreseeing industrial applications (FIA)
<i>Entrepreneurial commitment</i>	Induced motivation in founders (IMF)
	Time devotion to spin-off (TDS)
<i>Credibility acquisition</i>	Perception of spin-off reliability (PSR)
	Networking activity (NEA)
<i>Sustainability</i>	Learning processes (LEP)
	Organizational and managerial processes (ORM)

Building on the literature review and the research framework presented in previous sections, we employ two variables for each resource/juncture

matching. The role of university of origin resources in the opportunity recognition juncture has been measured in terms of whether and how these resources contributed in the identification of the business idea (IBI) and in the early foreseeing of the industrial applications (FIA) of the new technology offered by the spin-offs. Induced motivation in founders (IMF) and the time devoted to the spin-off (TDS) by the latter have been used to assess the impact that university of origin resources may have exerted in facing the entrepreneurial commitment juncture. The acquisition of credibility favored by resources provided by university has been measured assessing the impact that these resources exerted on the perception of spin-off reliability (PSR) and on its networking activity (NEA). Eventually, the matching between sustainability juncture and university of origin resources has been measured assessing whether and how these resources – in the post-entry phase - favored learning processes (LEP) and organizational and managerial (ORM) skills and procedures by spin-off's founders.

Results gathered with the direct interviews with spin-off founders, incubator's manager and TTO representatives are shown in boxes 1, 2, 3 and 4 and tables 1, 2, 3 and 4. Boxes 1, 2, 3 and 4 show the four case studies – information and qualitative evidences on the history of the spin-off and on the role that university of Turin resources have played in facing the four critical junctures are presented. While each company's history is based on facts, the description and the analysis of the role that university of origin resources played in facing the four critical junctures is the result of a mixing of facts and interpretations derived from the interviews.

Building on the case study analysis, the research team has then assigned a score to each variable employed to assess the resource/juncture matching for each spin-off using a 5-point Likert scale (1 = no impact of university resource on overcoming the juncture; 5 = high impact). Results are presented in tables 1, 2, 3 and 4.

*Box 1 - Case study: AgriNewTech*

**History.** AgriNewTech (ANT) is an academic spin-off of the University of Turin in the field of agricultural and environmental biotechnologies. The company has three product related patents and currently 20% of revenues is invested in R&D. Revenues in 2014 are around half a million euros - 30% derived from products and 70% from technology transfer and consultancy. Industrial production is entrusted to subcontractors and ANT protects its know-how with restrictive agreements.

**Opportunity recognition.** Massimo Pugliese, degree in agriculture, is the CEO of the company. Massimo's academic research activity originated the entrepreneurial idea. Market's feedbacks had already been tested prior to the spin off launch through free consultant activity mainly done for scientific purposes – the opportunity recognition process has been performed autonomously by the founder.

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**Entrepreneurial commitment.** It seems clear that Massimo's entrepreneurial spirit, passion for research and environmental protection have been - and still are - the main thrusts in the foundation of the company. While Massimo is fully committed in the venture, his full professors partners are currently not directly involved in the management of the company as they play an external scientific supervising role. The interview showed that an important role in stimulating and supporting Massimo's decision to launch ANT has been played by tutorship and management training services received by university incubator during the start up phase. His commitment has not been directly influenced by the fact that ANT is an academic spin-off.

**Credibility acquisition.** One of the indicators that ANT has gained credibility on the market are its agreements with other companies: dealers for agricultural business, area managers in North Italy and Piedmont shops to the final consumers. The interviews highlighted that today the university incubator remains important for ANT networking activities and for the possibility of collaborating with other start-ups that are part of it. University brand has also contributed to gain credibility on the market. As Massimo affirms in fact "*being an academic spin off allows to be known and have a wealth of relationships to be exploited for increasing the business*".

**Sustainability.** Born in 2009, ANT has reached sales for 454k euros in 2014. Considering the development in these first years, the financial independence, the absence of debts and the ability to set national and international agreements, the company seems to be able to generate sustainable returns. Interview with the CEO showed that the path to sustainability was followed without the university support. ANT future sustainability seems to be enhanced by the fact that its core business is coherent with social and environmental values worldwide recognized.

Table 1 – Level of impact of university resources on critical junctures: AgriNewTech (1 = no impact of university resource on overcoming the juncture; 5 = high impact)

Variables	TTO	Incubator	Brand
Identification of business idea (IBI)	1	1	1
Foreseeing industrial applications (FIA)	1	1	1
Induced motivation in founders (IMF)	1	4	1
Time devotion to spin-off (TDS)	1	4	1
Perception of spin-off reliability (PSR)	1	3	4
Networking activity (NEA)	1	4	4
Learning processes (LEP)	1	1	1
Organizational and managerial processes (ORM)	1	1	1

Box 2 – Case study: Biosfered

**History.** Biosfered is an academic spin-off born from the joining of academic competences of professors and researchers of the Plant Physiology Unit of the Department of Life Sciences and Systems Biology of the University of Turin. Biosfered produces identified and titrated plant extracts, which are the result of sound academic research on analytical chemistry and biochemistry of secondary metabolites. Biosfered target market is represented by several industries such as pharmaceutical, food and dietary supplements, cosmetics and feed industries. All Biosfered products are distributed by Faravelli Spa, an Italian distributor of raw materials. Currently located in the university incubator, Biosfered employs 4 people, most of them highly skilled. Accredited by FDA, Biosfered is growing quickly: 2013 revenues were 25k euros, those of 2014 were 250k euros and sales at the end of 2015 first quarter were 300k euros. The sales forecast for the end of 2015 is about 900k euros.

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<p><b>Opportunity recognition.</b> Massimo Maffei, 58, full professor of plant physiology, is the founder and R&amp;D Director of the company. His early business idea derived from the studies on nutritional supplements industry. A decisive role in the opportunity identification has been played by the participation to the regional contests. The university incubator guidance both for the enrolment and the business plans writing contributed to the fine-tuning of the business idea. At the same time, interview clearly showed that being a University of Turin spin-off company, together with its positive reputation effect, played a fundamental role in defining the business opportunity with its first clients (which are still customers today). No influence on the recognition of the opportunity has been exerted by university TTO.</p>
<p><b>Entrepreneurial commitment.</b> It was easy to detect that professor Maffei's entrepreneurial motivations are clearly positive, as he decided to launch the company to increase the value of his studies and those of his research team. The amount of his time devoted to the company, about 50% of his working time, demonstrates his commitment and interest in Biosfered. Maffei's commitment is certainly dependent on his personal characteristics and his desire to face a new entrepreneurial challenge at the peak of his academic career. However, an important role in stimulating Maffei's efforts has been played by tutorship and management training services received during the start-up phase by university incubator. Valued as important, these activities also made him realize that finding a reliable and competent industrial partner in order to fulfil managerial and administrative activities was extremely important. At the same time, it emerged from the interview that prof. Maffei is proud to run a company that originates from the university for which he has worked for many decades – this has a direct influence on the amount of time he devotes to the spin-off.</p>
<p><b>Credibility acquisition.</b> Fundamental indicators of Biosfered credibility on the market are its first customers, its capability to find an industrial partner and its ability to realize an agreement with an international distributor. University brand certainly seems to have deeply influenced the critical resources attraction capacity. Being a spin-off of the University of Turin it has emerged in the interview as a strategic asset that made possible attracting customers and stakeholders. On the other hand, the interview showed that lower influence on attracting critical stakeholders has been played by the TTO and the incubator.</p>
<p><b>Sustainability.</b> Born in 2013, Biosfered will be reaching about 900k euros sales in 2015. As compared to total fixed assets invested since start up (about 500k euros), the initiative seems to be able to create sustainable returns. While the company is still a small firm, it already employs 4 full-time people. From the interview it clearly emerged that the company has autonomously reconfigured its final products and developed managerial skills – it has obtained the FDA certification without university support.</p>

*Table 2 – Level of impact of university resources on critical junctures: Biosfered (1 = no impact of university resource on overcoming the juncture; 5 = high impact)*

Variables	TTO	Incubator	Brand
Identification of business idea (IBI)	1	3	4
Foreseeing industrial applications (FIA)	1	3	4
Induced motivation in founders (IMF)	1	4	4
Time devotion to spin-off (TDS)	1	4	4
Perception of spin-off reliability (PSR)	1	1	5
Networking activity (NEA)	1	1	5
Learning processes (LEP)	1	1	1
Organizational and managerial processes (ORM)	1	1	1

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*Box 3 - Case study: De.Tec.Tor*

**History.** De.Tec.Tor is currently an academic spin-off producing medical devices for advanced radiotherapy. Leveraging on technologies developed in the National Institute for Nuclear Physics (INFN) and the Department of Physics of the University of Turin, De.Tec.Tor designs, customizes and manufactures high precision particle detectors for on-line beam monitoring and daily quality assurance. The main customers of De.Tec.Tor are four *hadron-therapy centres* located in Paris, Zurich, Pavia and Vienna. A decisive role in the start up and early development of De.Tec.Tor has been played by Giuseppe Pittà, 36, founder and CEO of the company as well as head of the R&D function. While working to his business idea, Giuseppe joined Adam in 2009, a spin-off from CERN (European Organization for Nuclear Research) as R&D engineer and deputy technical director. Leveraging on his network, and while working in Adam (based in Geneva), Giuseppe founded De.Tec.Tor in 2009. Adam's CEO was involved in the funding of the company acting as a business angel. Currently located outside the university incubator, De.Tec.Tor employs 11 people, most of them highly skilled. While the total assets invested from start up reach 150k euros, 2014 sales are around one million euros.

**Opportunity recognition.** Given the nature of the technology studied which directly involves customer's use in order to be tested (therapy centers), the industrial applications of the technology were soon almost clear. An important role in the opportunity identification has been played by the learning process which derived from the participation to "MIP" and "Start Cup" contests. Both tutorship for building the business plan and management training on new venture creation offered by the incubator were valued as fundamental for the definition of the business idea by the founder. Likewise fundamental was the role that being a University of Turin spin-off played in the definition of the entrepreneurial opportunity. Leveraging on the University's brand made easy to get in touch with the therapy centres which "*would never had decided to experiment our technology if De.Tec.Tor wasn't an academic spin-off of the University of Turin* (which has a great tradition in physician field).

**Entrepreneurial commitment.** Unambiguous signals of Giuseppe's commitment were his decision to leave his "*well paid as compared to Italy*" job in Adam in order to devote more time to De.Tec.Tor and his decision to move back to Turin ("*while most of the nuclear physician fellows go from Italy to Switzerland, I am the only one who made just the opposite*"). While there is no doubt that Giuseppe's commitment is strictly linked to his personal characteristics, an important role in stimulating his efforts has been played by tutorship and management training services received from university incubator during the start up phase. As Giuseppe reported in the interview, he realized while tutored that managing a (new) company is a rough task and that the clear definition of shareholder agreements with Adam was strategic. At the same time, referring to the period in which De.Tec.Tor was incubated, the founder valued fundamental the role of the incubator in managing the administrative duties of the company. Being an academic spin-off of University of Turin has increased his personal motivation as Giuseppe values as strategic to keep on doing academic research while no direct influence on entrepreneurial commitment has been played by TTO.

**Credibility acquisition.** One of the most powerful indicators that De.Tec.Tor gained early credibility on the market is the ability to involve an angel investor. Another evidence of this capability are two technological partnerships that De.Tec.Tor established with two profit oriented companies: Giugiaro Design and National Instruments. What seems to have deeply influenced the ability to attract resources provided by these critical stakeholders is university brand. Communicating that De.Tec.Tor is a "spin-off of the University of Turin" has emerged in the interview as a strategic asset that made possible attracting stakeholders and building dense networks. A scarce influence on attracting critical stakeholders seemed to be played by the TTO and the incubator.

**Sustainability.** Born in 2010, De.Tec.Tor has reached 1 million euros sales in 2014. As compared to total fixed assets invested since start up (e.g. 150k euros), the initiative seems to be able to create sustainable returns. While De.Tec.Tor is still a small firm, it employs in its fifth year of life 11 full-time people. This is a signal of an entrepreneurial consolidation. The founder has organizational and managerial skills – however, the interview showed that no university resource was employed to favour this consolidation.

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Table 3 – Level of impact of university resources on critical junctures: De.Tec.Tor (1 = no impact of university resource on overcoming the juncture; 5 = high impact).

Variables	TTO	Incubator	Brand
Identification of business idea (IBI)	1	1	4
Foreseeing industrial applications (FIA)	1	1	5
Induced motivation in founders (IMF)	1	4	3
Time devotion to spin-off (TDS)	1	5	2
Perception of spin-off reliability (PSR)	1	1	5
Networking activity (NEA)	1	1	5
Learning processes (LEP)	1	1	1
Organizational and managerial processes (ORM)	1	1	1

*Box 4 – Case study: Sinbit*

**History.** Sinbit is an academic spin-off developing smartphone and tablet applications (apps) for big events. Main customers are Slow Food, International Books Exposition in Turin and University of Turin. Leveraging on software applications developed in Department of Informatics of the University of Turin, the main Sinbit products are designed and customized for Android, Windows and Apple. Currently located outside the university incubator, but within the Department of Informatics, Sinbit got its first customer – Slow Food - adapting its app to Samsung Tablet (Samsung was one of the main event sponsor) in 2012.

**Opportunity recognition.** The university incubator played a decisive role in the opportunity identification as the incubator management helped the founders to focus on “a business idea that should be of some interest to customers and not only to researchers”. Moreover the incubator assisted Sinbit in writing the business plan – this helped the founders in defining the business opportunity. In the early stage of the company, the founders didn’t leverage on the university brand name as the spin off authorization process ended in 2013.

**Entrepreneurial commitment.** As one of the founder, Fabiana Vernero, reported in the interview, “I started the company because I was looking for a good job and I was attracted by the possibility of choosing what to do in my life and whom to work with”. This desire of independence is linked with her personal commitment – she works almost full time in the company like one of the other two founders. Founders commitment seems to be related to personal characteristics. In fact neither TTO nor incubator management stressed the importance of being fully committed in the company. At the same time being a university spin off didn’t exert tangible effects on founders’ motivation.

**Credibility acquisition.** The indicators of Sinbit credibility on the market are its first big customers and its capability to adapt the products (tablet and smartphone applications) to different evolving needs and expectations. Even if the founders do not give priority to their “academic brand” in approaching the market, being a spin-off from the University of Turin did help Sinbit in acquiring the big customers. Likewise, the university incubator supported Sinbit in interacting with customers using a managerial approach.

**Sustainability.** Actually, this juncture doesn’t seem to have been faced yet by Sinbit.

Table 4 – Level of impact of university resources on critical junctures: Sinbit (1 = no impact of university resource on overcoming the juncture; 5 = high impact)

Variables	TTO	Incubator	Brand
Identification of business idea (IBI)	1	5	1
Foreseeing industrial applications (FIA)	1	4	1
Induced motivation in founders (IMF)	1	1	1
Time devotion to spin-off (TDS)	1	1	1
Perception of spin-off reliability (PSR)	1	3	4
Networking activity (NEA)	1	3	4
Learning processes (LEP)	n.a	n.a	n.a
Organizational and managerial processes (ORM)	n.a	n.a	n.a

Building on these results, Exhibit 3 synthesizes the main findings gathered in the empirical analysis on the level of impact of university of origin resources in overcoming academic spin-off's critical junctures. These findings are discussed in the next section.

Exhibit 3 – University of origin resources and level of impact played in facing junctures to spin-offs' growth (Levels of impact: Absent, Scarce, Moderate, Relevant, Fundamental).

	TTO	Incubator	University brand
<b>Opportunity recognition</b>	Absent	Relevant	Relevant
<b>Entrepreneurial commitment</b>	Absent	Relevant	Moderate
<b>Credibility acquisition</b>	Absent	Moderate	Fundamental
<b>Sustainability</b>	Absent	Absent	Absent

## 6. Discussion of results and managerial implications

Several information can be drawn from the empirical analysis. First, university brand reveals to be fundamental for academic spin-offs in gaining *credibility* on the market. The certification function of this brand works well when academic spin-offs get on the market and need to access start up resources from critical stakeholders. This finding shows support to the results obtained by Grandi and Grimaldi (2003) who investigated a sample of forty academic spin-offs in Italy and found that several companies did benefit from their affiliation to a university in establishing interactions with critical external actors. University brand's effects can be summarized as follows: brand facilitates the interaction with stakeholders such as banks, distributors, customers, suppliers; it confers reputation to the company; it

attracts critical stakeholders like managers and scientists; it reduces to zero the investment needed to create the spin-off's own brand. University brand has also played a relevant role in *recognizing the entrepreneurial opportunity* as it facilitated the interaction with first clients which were fundamental in defining realistic industrial applications of the new technology (as happened in Biosfered and De.Tec.Tor cases). At the same time, as emerged in Biosfered case, university brand evokes a "sense of belonging" and can induce *entrepreneurial commitment* in the founders (especially in long experienced academics). Second, the incubator also has emerged as an important university of origin resource in favoring the spin-off's growth process. The contribution of high value-added services provided by the incubator is relevant in favoring the *opportunity recognition* process and in inducing *entrepreneurial commitment* – a moderate role seems to be played by incubator in gaining spin-off *credibility*. Third, the empirical analysis has shown that TTO has invariably not played a critical role in facing obstacles to growth. However, as anticipated, this is due to the decision of University of Turin of transferring typical TTO's functions to the incubator thus leaving the office involved in administrative responsibilities (which are important as well but do not seem to have a direct influence on spin-off's growth). This particular division of labor between incubator and TTO has clearly affected the analysis - this is a clear limitation of this study which will be later discussed. Case studies has also shown that university of origin resources invariably do not affect the ability of academic spin-offs in reaching *sustainability*. None of the founders who faced this juncture has leveraged on university support to favor the acquisition of sustainable returns – what is more important is that none of these founders did expect that university of origin should have been involved in doing so.

Some managerial implications for universities wishing to improve the growth performance of their spin-offs can be drawn from the discussion of results. First, university managers involved in the promotion of academic spin offs should leverage as much as possible on the university brand. Spin-off companies should be induced to deeply leverage on this brand when attracting customers and other critical stakeholders. The effect on market credibility is direct and very powerful. Moreover, when dealing with low entrepreneurially committed founders, university managers should stimulate a corporate sense of belonging leveraging on the fact that spin-offs do reflect university brand. Other things being equal, this sense should induce academics to improve their involvement in the management of the company. Eventually, when interactions with first customers also contribute to the fine tuning of the spin-off products (which means opportunity recognition), university brand still plays a decisive role as it favors these interactions. Second, university manager should keep on investing resources directed at organizing well performing central incubators. These structures

in fact can reveal to be efficient in supporting spin-offs' growth process in reference to early phases of spin-off development (both opportunity recognition and entrepreneurial commitment). This means that university incubators may start acting as real entrepreneurship centers at the disposal of the university (Boh et al., 2015). Third, university managers should not invest resources for supporting spin-off companies when they are trying to reach sustainability. Empirical analysis has showed that when dealing with this issue, spin-offs behave as autonomous companies that do not seem to need any form of assistance.

## **7. Conclusions**

In this paper we have sought to shed light on the issue of limited growth of academic spin-offs. Grounded into the resource-based view of the firm, the paper has tried to detect the role that university of origin resources can play in order to provide academic spin-offs the power to grow. We focused on obstacles to growth that these ventures encounter before reaching the next growth stage as these obstacles can be seen as poor availability or lack of critical resources needed to proceed in the growth path.

It is important to recall that this paper and its framework derive from a research on academic spin-offs that is at an explorative stage. The next step of this research will be the validation of the framework using a sample of comparable Universities. This will provide evidence of the representativeness of the selected variables in measuring the level of impact of the university of origin resources on the growth of academic spin-offs.

Anyhow, results of this paper suggest a clearer understanding on the actual role of university of origin resources in overcoming the critical junctures faced by academic spin-offs. In particular, results shed light on which are the critical resources provided by university of origin and on how these resources can develop promoters capabilities in order to favor spin offs growth. In our empirical research it emerged that university of origin resources have different impacts on each obstacle to spin off growth.

These results should be used to improve the efficiency of university support in fostering academic entrepreneurship. In particular, this study could be of some interest to university staff involved in the promotion of spin-offs wishing to avoid that these companies just survive for long periods without growing and generating wealth. For university staff, facilitating post-entry significant growth is quite relevant as one can question that large parts of academic spin-offs are surviving just because they receive university support (van Geenhuizen and Soetanto, 2009).

## **8. Limitations and future research**

This study presents some limitations that need to be underlined and suggest areas for future research. First, the empirical analysis is based on the use of the case study which means a limited number of cases and limitations to the generalizability of results. A second limitation deals with the choice of considering one university. While several authors – as shown in section 1 - have investigated academic spin-offs stemming from a single university, we recognize that this somewhat limits the significance of the empirical analysis as universities vary in the way and the intensity with which they promote academic entrepreneurship. However, even if we focused on a particular university, we think that insights from this study may be extended to other local contexts in which structural factors like the innovation ecosystem (IPR regulation, venture capital diffusion, perception of entrepreneurship in the society and within academia), the universities involved and university support programs for spin-offs are comparable to those of this study. As anticipated, another limitation of the paper lies in the fact that the result according to which the TTO does not play any role in supporting academic spin-offs is affected by the particular division of labor between TTO and incubator adopted by University of Turin. In order to overcome this bias, new case studies based on different universities showing a different organization of labor should be performed in future research. Finally the findings presented here regarding the selected role of university resources on spin-off's growth suggest to adopt the same research framework in different countries with the aim of identifying whether this role is affected by local economic system and /or by different university support programs.

## **Abstract**

The importance of academic spin-offs as a possible driver of economic and social development is now widely recognized, and their University of origin is a significant variable. The paper analyses the role of specific resources provided by university of origin in the spin-off growth process: technology transfer office, university brand and incubator presence.

The research method is qualitative. It's based on the analysis of four high-tech academic spin-offs created in University of Turin and already on the market.

In particular investigation process analyzes the role of the three cited resources in overcoming obstacles faced by the spin offs in their various development phases and identifies key resources to overcome them. Therefore the article provides important managerial implications on the role that the University of origin should have in favoring the academic spin-offs growth.

## **Riassunto**

L'importanza degli spin-off accademici come possibile driver dello sviluppo economico e sociale è ormai riconosciuta, e la loro Università di origine è uno dei fattori rilevanti.

La ricerca indaga il ruolo di specifiche risorse fornite dall'Università di origine nel processo di crescita degli spin-off: ufficio di trasferimento tecnologico, brand dell'università e presenza di un incubatore.

Il metodo di ricerca è qualitativo e consiste nell'analisi di quattro spin-off accademici di settori high-tech dell'Università di Torino già presenti sul mercato. In particolare l'indagine empirica analizza il ruolo delle tre risorse citate nel superare gli ostacoli che lo spin off affronta nelle varie fasi di crescita e individua le risorse fondamentali per superarli. L'articolo fornisce dunque importanti suggerimenti sul ruolo che le Università di origine dovrebbero avere nello sviluppo degli spin-off accademici.

**JEL Classification:** M00; M1; M130

**Keywords (Parole chiave):** academic spin-offs, university of origin resources, growth (spin-off accademici, risorse dell'università di origine, crescita)

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