CLASSICAL AND EMERGENT PARADIGMS OF ACADEMIC ENTREPRENEURSHIP

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ABSTRACT

The academic entrepreneur’s choices and behaviours have been identified by Brennan et al. (2005) as the core field of interest of the research stream on academic entrepreneurship. The present work focuses on this core. The main goal of the paper is to present some classical and emergent models of academic entrepreneurship through exploring and focusing on the motivations of the entrepreneurial decision. Risk aversion, desire of independence, economic and financial reward and “academic return” are the key drivers of the critical decision to start-up a new venture within an academic context. This explorative study is based on two polar case studies, which analyze two different models of hybrid entrepreneurship.

1. INTRODUCTION

During the last decades the role of scientists and the career opportunities of academic researchers radically changed. Nowadays dedicating time and efforts to become a star scientist or trying to obtain an important university chair, does not mean only expecting a future made of exciting scientific discoveries, conferences, leading publications and international academic reputation. In fact star scientists and brilliant professors have the opportunity to commercially exploit their ideas and their technological innovations, by creating (or contributing to create) new ventures, and thus producing profit, wealth and job places. This phenomenon is evident in many universities of the world, and it has been labelled by scholars as ‘academic entrepreneurship’. This global revolution is part of a general social transformation of the academic institutions which are shifting from ivory towers of knowledge to agents of economic and social change. According to Shane (2004) university spinoffs, and especially their creators, are therefore important subjects to study because (i) they contribute to local and national economic development, (ii) they are useful for commercializing new technologies and innovations, (iii) they offer to the universities an instrument for implementing their third mission (Etzkowitz 2004), (iv) they are often high performing companies and (v) they produce more profit for universities than licensing intellectual property to established companies.

Science has emerged as a complementary engine of economic growth to the classic triad of land, labor and capital (Etzkowitz 2004). The Academia is one of the main “loci” of production of science and technology. While some authors think that a more integral understanding of the process of creating university knowledge based spinoff is still on its infancy (Shane 2005, van Burg et al. 2008), academic entrepreneurship can be considered an emerged field of research. A robust body of knowledge have been published, and diffused during the last years - particularly since 1999 (Rothaermel et al. 2007) – even if some topics have been under-researched and thus they still need to be clarified or updated.

Different units of analysis, geographical areas, theoretical and methodological perspectives have been used (Rothaermel et al. 2007). As far as the university-industry relationship is concerned, scholars have been focusing mainly on: incubators ad science parks (Phan et al. 2005), spin-offs creation (Grandi and Grimaldi 2005, Link and Scott 2005, van Burg et al. 2008) technology transfer offices (Wright 2004, Siegel 2006 Markman et al. 2008), intellectual property management (Link and Scott 2005), environmental contexts and networks (Powers and Mc Dougall 2005, Feldman et al. 2002, Medda et al. 2005). Only a few authors (Louis et al. 1989, Hsu 2007, Fini et al. 2008) studied the key actor of the academic entrepreneurial process: the academic entrepreneur, who is the person that “balances the disciplinary considerations with the technology transfer strategy of a university
institution and the opportunities arising from exploiting intellectual capital through technology-based firms" (Jones-Evans, 1987, Dickson et al., 1998, Birley, 2002, Laukkanen, 2003). The academic entrepreneur’s choices and behaviours have been identified by Brennan et al. (2005) as the core field of interest of the research on academic entrepreneurship. The present paper focuses on this core. The main goal of this work is to present some classical and emergent models of academic entrepreneurship, by exploring and focusing on the motivations of the entrepreneurial decision. The seminal question on entrepreneurship formulated for the first time by Shane and Venkataraman (2000) can be thus adapted to our context: why and how young academics or full or associate professors exploit technological opportunities and the potential competitive advantage that arise from them in order to create innovation, wealth and profit? The two authors define entrepreneurship as “the nexus of two phenomena: the presence of lucrative opportunities and the presence of enterprising individuals”. Since their work (2000) many authors tried to describe the “nexus”: it can be considered the real ‘ignition spark’ of every entrepreneurial experience. In this paper we will try to explore this nexus, presenting it as a dilemma. In fact as Shane and Venkataraman suggest: “subsequent to the discovery of an opportunity, a potential entrepreneur must decide to exploit this opportunity”. The choice of the entrepreneur is therefore a crucial issue in the business creation process. As far as academic entrepreneurship is concerned, this decision is undertaken by one or more faculty members who decide to exploit commercially the results of their research activities or part of their tacit knowledge. The decision can be influenced by internal or external factors: the internal factors are called the motivations (which will be discussed deeply in this paper) and the external are called incentives or barriers. The cases presented in next sections show how strong motivations drive the critical choice of the academic entrepreneur, influence the business model and, in particular, the role chosen by the entrepreneur. On one hand, in fact, context incentives and barriers to academic entrepreneurship have been already studied (Shane 2004, Stuart and Ding 2006, O Shea et al. 2004), on the other, only a few contributions focus on entrepreneurial motivations within an academic environment.

Before presenting the theoretical framework and the case selected case studies, it is important to present and share some definitions. Since different prospective and ideas are actually used by scholars, according to Fini et al. (2006) we define an academic spin-off as a company that has either a university (or public academic research centre) or at least one academic/researcher (full professor, associate or assistant professor, senior or young researcher, lecturer, or Ph. D. student) among the founders. Following the same authors, with “academic entrepreneur” we refer to an individual who having a work experience within university, decides to found a new venture based on academic knowledge and on the experience that (s)he has gained at the university.

The rest of the paper is organized as follows. The second section presents the specific aims of this research and an extensive and selective literature review of some useful results. Classical and emergent paradigms of academic entrepreneurs are presented in the third section of the paper. Advantages and disadvantages of each model are described and motivations are analyzed. The fourth section focuses on some methodological issues. The fifth and the sixth sections present two polar case studies. The last sections are dedicated respectively to the discussion of the empirical evidence, the conclusions of this work and a future research agenda.

2. RESEARCH OBJECTIVES AND LITERATURE REVIEW

Spin-offs are rare phenomena (Shane 2004), with the exception of some interesting areas in USA and Europe (such as the Silicon Valley, the Boston area, Lueven (Belgium), Twente (the Netherlands), Cambridge(UK)). Even if they do not constitute a homogeneous category (Wright et al. 2008), some common elements can be highlighted. They are innovative firms not only because of their products or processes but also because of the business model adopted by the entrepreneurs. In the first years of their life, academic start-ups are small and smart enterprises. Different taxonomies have been introduced by scholars (Mustar et al. 2006, Shane 2004, Wright et al. 2008) in order to conceptualize the heterogeneity of research-based spinoffs. While the contribution of Mustar et al. (2006) is focused on dimensions like the type of resources, the business model and the institutional link, this paper is focused on the entrepreneur. The first objective of this work is to propose and to highlight a classification between classical and emergent paradigms of academic entrepreneurship. Models are useful tools to understand, explain and predict phenomena even if they often reduce the complexity and the richness of the entrepreneurial phenomenon.

The second aim of the paper is to focus on the decisional process of becoming an academic entrepreneur and to study the consequent complex metamorphosis of a pure academic into an entrepreneur. To introduce this research question we can therefore readapt the popular Shakespearian rhymes: “To be or not to be (an entrepreneur). That is the question.” Or reformulating it in a better
way: “To start up or not to start up. That is (again) the question.” When a technological opportunity arises, the academic can continue her/his research activities, publishing, patenting and teaching or (s)he can follow new goals like profit, wealth, economic development, by shifting her/his role from simple professor to an academic entrepreneur. When a Ph.D. student in subjects like Engineering, Physics, Computer Science or Medical Sciences has valuable ideas, potentially exploitable from a commercial point of view, (s)he can give up scientific objectives and dreams and invest time and efforts in a new entrepreneurial experience. What are therefore the motivations of their rational choices? Scientist and professors could leave the university world and their research activities to completely dedicate to their new business. Otherwise they can decide to maintain the academic role and could accept a part time position in the firm. As we will see in next section, many patterns are available. While some external factors can influence potential entrepreneurs’ decision (as many literature contributions demonstrate), we can suppose that some deep motivations drive directly their decisional process. That’s the reason why we use the evocative image of “a dilemma inside the nexus”.

Moving to an entrepreneurial career position would require a “reworking of internal values and beliefs to meet new aspirations and institutionalized sets of the expectations of the university and the commercial world. (Warren 2006). Even the recent work by Wright et al. (2008) explains that the potential academic entrepreneur may need to make an important choice about whether to remain as a professor/researcher or become involved full time or part time in the venture. This critical phase is called by the authors the “entrepreneurial commitment” and it is described as a critical juncture in the phase model of spin off development. In their framework it is located between the opportunity recognition phase and the pre-organization phase. Accepting a critical career decision (Nicolau and Birley 2003, Warren 2006) is not an easy choice for the following reasons (Wright et al 2008): (i) lack of networks to access successful entrepreneurial role models, (ii) absence of prior business experience, (iii) lack of confidence about surviving in a difficult environment, (iii) absence of awareness of personal characteristics and capabilities, (iv) accessing the help of a surrogate entrepreneur (Franklin et al 2001) because of limited social capital. Analyzing the decisional process, we also take in account the situation described by Wright et al. (2008): academics who want to start up company not only face resistance within the university system but also have to convince their friends and family about such a career change.

The third objective of the paper is to explore some possible relations between the motivations of the entrepreneurial choices and the entrepreneurial patterns. Some hypothesis will be formulated in order to study how the choice made by the academic entrepreneur is influenced by the key motivations.

This paper is relevant 1) for every potential academic entrepreneur, in order to better understand business opportunities and adopting the right strategies 2) for the governance system of universities, in order to better understand the behaviours of academics and to better fit the third mission of economic development (Laukkanen 2003, Etzkowitz 2004), 3) for managers and venture capitalists who need to understand the organizational and institutional peculiarities of universities in order to properly evaluate the return from collaborations, and joint entrepreneurship (Oakey 2003) and to anticipate the behaviours of their academic business partners (Lacetera 2006).

The theoretical framework of this research refers to the complete end exhaustive studies by Shane (2004) and Wright et al. (2008), enriched by the results of two works by Fini, Grimaldi and Sobrero (2006, 2008). They analyzed the factors affecting academics’ decision to start up a new venture. The study is based on a survey of Italian academics who have been involved in the creation of academic spin-offs. More specifically they surveyed academic spin-offs of the Emilia Romagna region, which has been identified by the EU commission as one of the leading regions in Europe for its increasing number of research start-ups. They integrated different perspectives on determinants of spin-offs creation in a single comprehensive framework (Figure 1), which distinguishes between incentives reflecting characteristics of the external environment, (environmental influences), incentives reflecting university intervention (university level support mechanisms), and incentives reflecting academic founders expectations (individual level related factors). Environmental influences include local context factors, government support laws and programs, industry and technology characteristics. The local context may be seen as a set of competencies and resources both tangible (physical infrastructure, corporate physical assets, R&D laboratories) and intangible (human capital, knowledge, routines) (Niosi and Bas 2001). Special laws or national agencies can be considered as mechanism created by National Government in order to support the creation and the development of academic enterprises. As University level support mechanism we consider the set of policies and instruments that can be used by Universities to support academic spin-off (business plan competitions, technology transfer office, incubators). The main individual factors identified by Fini et al. (2006) are: personal
outcomes that academic entrepreneurs are expecting out of their involvement in the new venture creation process, personal earnings, prestige and reputation.

From a general point of view four major research streams have been identified by Rothaermel et al. (2007): (i) entrepreneurial research university, (ii) productivity of technology transfer offices, (iii) new firm creation and (iv) environmental context including networks of innovation. This study can be included in the third stream about new venture creation. The study of entrepreneurship at individual level has been quite popular in the last years. Many contributions demonstrated that the choice of becoming entrepreneur is influenced by factors like previous education (Storey 1994), previous job (Taylor 2001), age, gender and other personal characteristics. Since the seminal work by McClelland (1976) a research stream flourished around the “traits theory” and from the works by Miller (1983), Covin and Slevin (1986,1989) and Lumpkin and Dess (1996) another stream flourished around the construct of entrepreneurial orientation. As far as academic entrepreneurship is concerned some authors like Lockett et al. (2005) and Fini et al. (2006) are convinced that additional research is required at individual level in order to investigate the relevance and the role of academics entrepreneurs’ motivations, incentives and capabilities in developing successful academic ventures. Exploring individual level characteristics can help on understanding how entrepreneurial orientation, skills and the perception of support mechanisms influence the academic start-up performance.

The evolution of a scientist or academic towards entrepreneurial goals, can be considered a complex process of career transformation which passes through the creation of an entrepreneurial identity. In fact the creation of an academic spin off presents challenges both for scientist and engineering researchers (Warrenn 2008). For example it involves a transition from a non commercial to a commercial environment. And even if a research group can be managed as a “quasi firm” (Etzkowitz 2004), running a firm is indeed completely different from doing research. If “publish or perish” can be considered the “motto” of the academic world, “Market or perish” is the motto of the whole business world. And the two mottos are radically different.

Another interesting result for our analysis is presented in the paper by Fini et al. (2008) and regards the comparison between fully enrolled and pro tempore enrolled academic entrepreneurs. In their work they discovered that for fully enrolled scientist the orientation towards corporate innovation, risk and pro-activeness is lower than for pro tempore enrolled scientists. In fact these latter show a higher attitude towards entrepreneurship.

In order to complete the literature review, we highlight some results about the role and the importance of work context as crucial element in the decision to create a venture (Stuart and Ding 2006, Di Gregorio and Shane 2006, Bercovitz and Feldman 2008). For example Bercovitz and Feldman tracked 1780 faculty members, examining their backgrounds, work environments and their eventual activity as academic entrepreneurs. They found that individuals are more likely to participate if they trained at institutions that had accepted entrepreneurial initiatives and been active in technology transfer. In addition they found that when the chair of the department is active in tech transfer, other member of the department are also likely to participate, confirming the “contagion effect” presented by Shane. Some contributions focus on public support mechanisms, policies set up by universities and incentives. An extensive review of this topic is offered by the second chapter of Wright et al (2008).

3. ENTREPRENEURIAL PARADIGMS AND MOTIVATIONS
The four paradigms. Traditionally the idea of academic entrepreneurship includes graduated students and professors who give up their research activities within the university, by creating new ventures. In fact some of them, after the first revenues and profits, feel entrepreneurship and managing their firms, more interesting and profitable than studying or doing research. Some of these full time entrepreneurs (former students or young academics) received frequent media coverage. Analyzing recent and old literature contributions and comparing them with some empirical analysis (Giacon 2008), four main paradigms of academic entrepreneur can be summarized and presented. The first model is the consultant. (S)He is a professor who provides consultancy services as self employed, without giving up his role and position within the university. This is not a negligible phenomenon: it is a valuable way of transferring technology and knowledge from universities to firms. In fact some studies confirm that this is a paradigm still actual and diffused. For example Klofsten (2000) and Jones Evans (1987) investigated the entrepreneurial activities of 1194 academics from the universities in Sweden and 663 academics from five universities in Ireland and they found a high degree of involvement in “soft” entrepreneurial activities such as consultancy and contract research but not in new firm creation through spinoffs. Even the work by Bains (2005) supports the importance and the diffusion of consultancy activities. In his paper he presents the four main options for making money through commercialization of technology and academic know-how. They are respectively: licensing intellectual property, owning shares in a spin-off firm, personal consulting and writing books. Consulting is, in his results, the economically most rewarding option.

The second model is the “former academic” who decided to become a full time entrepreneur. Sometimes this choice can be spontaneous, some other times it can be forced by the impossibility to join the faculty because of academic competition or lack of financial resources for recruiting. This situation can happen especially at the beginning of the academic career of a young researcher. Since his seminal work, Roberts (1991) identified the model of an academic entrepreneur both involved in start-up activities, and enrolled within the university. The scientist does not abandon the chair and research activities within the university and at the same time he can run a firm. We call this figure “hybrid entrepreneur”, because, at the end, he is half professor and half business owner. The hybrid entrepreneur is therefore involved half in research and teaching activities, half managing and leading the business. Nicolau and Birley (2003) presented this model and used for the first time the term hybrid. In some cases the business role of the academic entrepreneurs is executive, in some cases it is limited to R&D management.

The fourth model is the hybrid pro-active entrepreneur: it will be described in the last case study of this paper. The hybrid pro-active entrepreneur is a hybrid entrepreneur who dedicates part of his time at teaching and researching and her/his “business time” as a catalyst of entrepreneurial activities. He is not exactly a business angel, but a promoter of different technological enterprises inside the academic environment.

Many contributions analyze the performance of hybrid academic entrepreneurship. In this paper we are not interested to explore the performance of the entrepreneurs, rather the motivations that drive their choice to start up a new venture. The need to provide a complete overview of the paradigm, ask to discuss briefly the question whether scientific and research output of academic entrepreneurs is different from the output of their non entrepreneurial colleagues. On this issue the ideas are opposite. In fact from one hand van Looy et al. (2004) demonstrated that entrepreneurial performance and scientific performance do not hamper each other. In their study over the performance of the 14 departments of the Katholik University of Leuven, they have shown that engagement in entrepreneurial activities coincides with increased publication outputs without affecting the nature of the publications involved. As resources increase this interaction becomes more significant, showing a Matthew effect. Their results are confirmed by Lowe and Gonzales-Brambila (2007) who presented a study over 15 universities and found that faculty entrepreneurs are more productive researchers than non entrepreneurial academics. They found no evidence that starting a firm has a detrimental impact on entrepreneurs research productivity (measured as number of publications per year). In particular faculty entrepreneurs are more likely to be star scientists, based on citations to their work, than their graduate school peers, co-authors, and the faculty members in general.

On an other hand other studies highlight a potentially costly trade off: the time and effort of hybrid academic entrepreneurs are diverted away from academic knowledge creation. This is presented by Toole and Czanritziki (2007): in their view this phenomenon can be considered as a form of “brain drain on the not-for-profit research sector which may reduce knowledge accumulation and adversely impact long-run economic growth ”. The two authors surveyed all university life sciences researchers in the fields of biology, chemistry, health sciences who have received at least one research award from the U.S. National Institute of Health between 1972 and 1996. They found a significant decrease in the
research performance within the group of NIH academic entrepreneurs after they begin working in firms. Their results are coherent with the studies by Zucker and Darby (1998) and Powell and Owen Smith (1998).

Hybrid roles can present some negative effects (Blumenthal et al 1996): researchers might delay publication or not publish at all in order to maintain secrecy around a particular innovation. It is possible that they allocate more time in the technology transfer office, managing their inventions, engaging in consulting or creating start-ups.

These opposite opinions can be reconciled (as suggested by Rotharmsel (2007) and Siegel et al. (2004), and partially by van Looy et al. (2004), by observing that the mission of universities today requires a balance of both traditional and entrepreneurial roles and suggesting that the two roles may actually complement and reinforce each other.

Hybrid academic entrepreneurship is a phenomenon that can happen only if the university allows part time employment and leaves of absence in order to encourage spinoFF company formation because, as noted by Shane (2004) “ many academics do not want to leave their positions permanently and give up tenure and secure salaries to spinoff companies. Forcing academics to undertake their entrepreneurial activity on a full time basis, without the security of their primary academic position, increases the risk of being an entrepreneur and so discourages spinoff activity”. The works by Tornatzky et al 1995 and Mowery and Ziedonis (2001) showed that the universities that allow faculty members to work in spinoFFs and that permit them to take leave of absence to run their firms, have more spinoFFs than other universities.

The main characteristics and behaviour of the four models presented can by summarized by the following table, in terms of advantages (Pros) and disadvantages (Cons)

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<th>model</th>
<th>PROs</th>
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<td>the consultant</td>
<td>The consultant can exploit the whole academic network and a recognized academic social status. Low impact on publication rate. Low entrepreneurial risk. No need of banks’ help or strong financial support. It is considered one of the most rewarding academic activity</td>
<td>Limited time dedicated both to business and to academic activities (researching and teaching) Low autonomy and independence. Strict time-cost-quality-results ties. The entrepreneurial activity can be reduced to simple knowledge and &quot;problem solving&quot; outsourcing. Sometimes there could be an overlapping between research and business</td>
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<td>the former academic</td>
<td>All the time is dedicated to business activities. Complete autonomy in choosing the business model, management policies, competitive strategies. If the university offers leave of absence legislation, the entrepreneur has the opportunity (in case of failure or after a trial period) to come back to the academic world. Publication is often abandoned because of new goals.</td>
<td>Links with academia are weaker. (it reduces opportunities). High risk activity, need of third part financial support (banks or venture capitalists). Less time for research activities. Need of balanced entrepreneurial, technical and managerial skills</td>
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<tr>
<td>the hybrid entrepreneur</td>
<td>Intermediate entrepreneurial risk. This choice let the academic entrepreneur both to keep the reputation, the power and the networks typical of the academic world and in let him to run his business in a part time way. Sometimes the university owns part of the equity. Not limited academic performance (van Looy et al. 2004)</td>
<td>Limited time dedicated both to business and to academic activities (researching and teaching) Need of surrogate entrepreneur or entrepreneurial teams (limited autonomy). High risk activity, need of third part financial support (banks or venture capitalists). Sometimes overlapping between research and business. Potential brain drain on the not-for-profit research sector which may reduce knowledge accumulation and adversely impact long-run economic</td>
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The motivations. Many papers (Stuart and Ding 2006, Fini et al. 2007) and books (Shane 2004, Wright et al. 2008), describe the relevant factors that influence the choice made by scientists or professors when they become entrepreneurs. Some of these factors are: the typologies of job contract between the university and the professor, the entrepreneurial ecosystem and the intangible infrastructures present in the geographical area of the university (Venkataraman 2004), the subjects and the technologies researched by the academician, the presence of risk capital markets and investors (venture capitalist or business angels), and finally the “emulation factor” which is the diffusion of successful business models and cases inside the academia. Many of these external factors have been operationalized by the recent work of Fini et al. (2006).

Our analysis is complementary to the paper by Stuart and Ding (2006). In fact while we want to highlight some deep motivations, these two authors explore the external social factors (social mechanisms) that influence the decision making process of job shifting from university to entrepreneurship. They found that faculty members are more likely to become entrepreneur when they work in university departments that employed other scientists who had previously ventured into the commercial sector. The effect of working with academic entrepreneurs is largest when those having commercialized their work are star scientists and has attenuated after the spinoff fashion had significantly diffused across the community of academic scientists.

Scott Shane (2004) dedicated part of the eight chapter of his book to the motivations to spinoff. He offers two families of explanation: a psychological explanation in which scientists and academics found companies to put their technology into practice or obtain wealth or independence, and a career oriented explanation in which academics found spinoffs because of their career stage. Other career related factors identified by the same author are the university status (in particular being a star scientist or at the top academic), and the previous entrepreneurial experience.

Comparing these contributions with the empirical evidence of an exploratory study (Giaccon 2008), we can formulate the hypothesis that some motivations are stronger than others. We can therefore suppose to identify four main drivers that can be considered as deep motivations of the entrepreneurial choice of a potential academic entrepreneur. They are the desire of risk bearing, the desire of independence and autonomy, the economic and financial reward and the academic reward.

Riskiness is one of the dimension of the entrepreneurial orientation construct. The other dimensions are innovativeness and pro-activeness (Miller, 1983; Covin and Slevin, 1989 Lumpkin and Dess, 1996). Although we respect entrepreneurial orientation research stream and we consider this construct as a valid tool to evaluate and describe the entrepreneurial process, we think that the research of the motivations and the determinants of academic entrepreneurship cannot be limited to the three dimensions operationalized by Lumpkin and Dess. The desire of autonomy and independence is a key driver in every entrepreneurial experience (Shane 2004): it is the opportunity to change part of the professional and personal life of a person. While the economic and financial reward can be considered as a trivial motivation, the “academic reward” need some further explanations. In fact it includes all the benefits obtained through academic activities, in terms of career, social status improvement, professional success, acknowledgment among the worldwide research community. The idea to formalize the “academic reward” (or return) as a strong motivation of the entrepreneurial choice comes from the work by Fini et al. (2006) In fact one of the main result of their work is that Italian academics’ involvement in creating new ventures is not driven by entrepreneurial attitude, but rather by the expectation to generate outcomes for enhancing their academic position. As we will see in next sections, this result will be confirmed by the first case study.

4. METHODOLOGY

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<td><strong>the pro-active entrepreneur</strong></td>
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<td><strong>growth (Toole and Czarnitzki 2007)</strong></td>
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The empirical base of this work is composed by two polar cases of academic entrepreneurship. According to Yin (2002) and Flyvbjerg (2006), the exploratory nature of this study suggests the use of a qualitative methodological approach, and in particular the multiple case studies research tool. This choice seems to fit with the questions underlying the paper. The inductive research helps the possible emersion of new situations and behaviours of the economic and social actors. The choice of case studies is supported by the explicit suggestion of Eisenhardt (1989) inviting the academics to use this tool for providing freshness in perspective to already researched topics and in the early stage of research on a topic. Multiple case studies research is furthermore a useful tool to understand the complex nature of entrepreneurship, as recommended by Gartner and Birley (2002)

The main limit of this approach is the possibility to present general determinants of phenomena through a limited number of cases. This limit can be widely accepted because the goal of the paper is not to demonstrate general causal relations, but to present empirical evidence, by describing paradigms and conceptualizing personal motivations of the entrepreneurial choice.

The two academic entrepreneurs, presented in next sections come from the same Department of the same University. This choice has been made in order to highlight the role of motivations and to compare entrepreneurs of the same context and ecosystem. In fact the two entrepreneurs are exposed to the same set of university and department policies towards academic entrepreneurial activities.

A robust research protocol has been built in order to guarantee the reliability of the collected data. The cases are based on semi-structured interviews with the entrepreneurs. Starting from their personal story and career, the interview covered the following topics: the entrepreneurial choice, (motivations, incentives and barriers), the background of the entrepreneur and the main aspects of the “entrepreneurial life” of the firm like: the products, the market, innovation activities, networks, the strategies adopted in early years. The analysis of the annual reports, the website and other information available on the Internet have been performed before and after the meeting with the entrepreneur. A single case study has been written for every enterprise by the researcher, in order to summarize and fix the interviews and the entrepreneur and the author’s personal opinions and considerations. A feedback mechanism has been exploited: every single case has been read, rectified or amended by the entrepreneur.

5. CASE STUDY A: ENRICO PAGELLO AND IT+ROBOTICS

Enrico Pagello is full professor at the Departement of Information Engineering of the University of Padua, Italy. His fields of research are Artificial Intelligence, Robotics, Distributed Computing. He received a "Laurea in Ingegneria Elettronica" at the University of Padua on 1973. From 1973 till 1983, he has been a Research Associate at the Institute on Biomedical Engineering of the National Research Council of Italy, where now he is a part-time collaborator. Since ‘83 he has been a member of the Faculty of Engineering of The University of Padua. He publishes in important international journals and reviews. He was a Visiting Scholar at the Lab. of Artificial Intelligence of Stanford University and He has visited regularly the Departement of Precision Engineering of The University of Tokyo, since 1994. He founded IT+Robotics, a spin-off of the University of Padua (which is the owner of 5% of the Company) in 2005. The entrepreneurial team is composed by seven partners (academic and non academic team). The core of the spin-off activities are the commitment and entrepreneurial spirit of Professor Pagello’s research team.

IT+Robotics is operating on the most extreme frontiers of innovation: humanoid robotics, artificial intelligence and advanced vision systems. Professor Pagello considers himself as a pioneer, moving in that difficult and complex area between business and university, creating precious contacts, vital synergies and new paths towards innovation and encouraging collaboration between these two worlds. The company sells video-surveillance systems integrating autonomous robotics with innovative technologies in the field of artificial vision and the acquisition and transmission of omnidirectional images; on the other, it deals with the marketing, development and customization of humanoid robots.

"On the basis of studies which have been carried out in our department and by the international scientific community for years now - claims the Professor – our Company has put itself forward as a consultancy partner in the field of artificial vision for the realization of customized prototypes of video-surveillance and security systems that integrate the most advanced and sophisticated technologies available on the market today." The company imports from Japan and other countries humanoid robots and adapt them to the needs of western customers.

Extensive university research and years of experience have, in fact, enabled these robots to be enhanced with an added value: the technicians and engineers of IT+Robotics are capable of
customizing them and programming them to requirement. If we were not talking about machines we could almost say that they are capable of giving these robots a soul. Clearly, this sector is a real niche with very few competitors: in fact, there are no other companies in Europe capable of supplying the services and skills of this small start-up company.

One of its activities is that of organizing brief demonstrations at companies, schools, universities and trade fairs. “Autonomous robotics is something which appeals to adults and children alike – says Professor Pagello – as the fascinated expressions which inevitably appear on their faces show each time artificial intelligence is encountered, this technology still being linked to pure science fiction.” The aim of these “robotic demonstrations” is, therefore, to stimulate curiosity and spread knowledge regarding the recent developments of what, in the not so distant future, could become a part of everybody's daily life. The staff of IT+Robotics mainly hail from the research sector; many are university lecturers who have been working for many years in the field of intelligent robotics and who are involved in the most important international associations such as SIRI, the Italian Robotics Association, AI*IA, the Italian Association for Artificial Intelligence, the International RoboCup Federation, the Intelligent Automonous System Society, etc. The presence of these academics means that the company has contacts with the best international research networks in Europe and the world.

“Our academic staff is flanked by brilliant engineers who make up our technical staff, boasting skills in the most up-to-date information technologies – claims Pagello. Lecturers and engineers have experienced two years of intense activity and enthusiasm together, maybe stimulated by the desire to create innovative solutions rather than the idea of making profits at all costs: “We have had positive financial statements two years running and we are extremely satisfied; of course, our turnover is not that high but we have had a lot of professional gratification, also from carrying out a number of projects with several Italian companies”, declares the Professor. For example, IT+Robotics has developed a system for detecting defects in irregularly-shaped glass bottles, eliminating many of the constraints posed by other commercial solutions. In particular, the Company has been concentrating its efforts on a system to inspect glass perfume bottles of all shapes and sizes, plain or satinated, for defects.

The mission inspired by Enrico Pagello is a fascinating mix of research and business. Once they have become part of the mechanism of market and competition, many university spin-offs lose their drive for research, switching their focus to the product, marketing and small incremental innovations. On the contrary, the management of IT+Robotics has chosen to create a permanent bridge between universities and businesses. One of the pillars of this bridge is obviously research. The Pagello group has therefore chosen to go into business in order to get closer to enterprises. Pagello admits he has even been able to extract new stimuli for researching and developing knowledge from activities closely connected to products, trade and marketing. “We have supplied services, sold products and developed projects; these activities are radically different from those of writing scientific articles or books, the main task for people who work in university research. We have come to the conclusion that even these business activities can offer us ‘food for research’ and new stimuli. We have succeeded in enhancing the competences and know-how developed at University, even if our small spin-off still has a very long way to go”.

6. CASE STUDY B: RUGGERO FREZZA AND M31

Ruggero Frezza obtained the Laurea degree in Electrical Engineering with highest honors from the University of Padova. He was awarded the 'Antonio Sarpi' prize for the best graduate of the engineering school in the year 1985. In 1990 he obtained a Ph. D. in Applied Mathematics at the University of California Davis where, in 1987, he also obtained a Master of Science in the same field. In 1990 he joined the department of electrical engineering and computer science of the University of Padova as assistant professor. In 1992, he was promoted to associate professor of automatic control. He is responsible of the laboratory of computer vision and autonomous navigation. Ruggero Frezza research interests are in stochastic modelling and estimation, nonlinear control, computer vision and vision based control of vehicles, tracking and data association. He has held visiting positions at the IIASA (International Institute for Applied Systems Analysis) Laxenburg Austria, at the Royal Institute of Technology, Stockholm Sweden, at the University of Groningen, The Netherlands and at the Robotics Lab. of the University of California Berkeley. In the year 2000 Ruggero Frezza founded the first spin off company of the University of Padova, eMotion s.r.l., that develops optical motion analysis systems. In the following years he founded other three spinoffs, confirming his orientation towards serial entrepreneurship.

M31 is the name of his last spinoff: the company is located only a stone’s throw from the Department of Engineering of the University of Padua. A great location for a young company whose
focus is to supply engineering skills in the new frontier technologies and to create a network of contacts among businessmen, researchers, consultants, investors and managers, with the aim of facilitating and supporting the creation of knowledge-intensive enterprises. The name chosen for this young company is highly allusive: indeed, it was chosen by the founders in order to make specific reference to the Andromeda galaxy. But why a galaxy? And why Andromeda in particular? Professor Frezza says: “We chose the name of a galaxy because we liked the image of a mass of celestial bodies, apparently scattered at random, but held together by a single nucleus acting as a pole of attraction. In the same way, M31’s aspiration is to become the same kind of strong nucleus, capable of attracting talents, qualified partners, ideas for sustaining innovation and economic development. Out of all the galaxies, Andromeda is a particularly interesting one in that it has two nuclei of attraction. Transferring this idea to our Company, the first nucleus represents its strong identity, anchored to ethical values of transparency, trust and honesty. The second, on the other hand, is linked to the concept of partnership. In fact, we prefer to talk about partners rather than clients. Our aim is to create a shared profit company model where relationships with our partners, suppliers, collaborators and stakeholders are based on the binomial win-win.” Frezza speaks with determination and pragmatism. He is a university lecturer, in his forties, who has proved to be not only a skilful researcher but also a real Schumpeterian profile, with the commercial ability to exploit technological opportunities.

M31 is a company whose mission is to generate high-tech enterprises. The Company itself was constituted with a joint stock equal to €350,000 and operates in three main areas. The first is made up of research and consultancy on behalf of third parties. The second area regards the development of its own products and intellectual property (IP). The third one concerns the design and creation of new, knowledge and technology intensive enterprises. “Our main aim is to become a real and proper catalyst for innovative enterprises. Our strategy is based on the exploration and creation of collaborative networks involving businessmen, universities, research centres, business angels, investors and venture capitalists, - states Ruggero Frezza – We have created a team of professionals with great expertise and skills in basic qualifying technologies and we have begun to assemble contacts and construct alliances with successful companies in a variety of sectors. Furthermore, we are also part of a capillary, technological transfer network, working together with public and university research centres. In particular, we collaborate constantly with the University of Padua – some of its researchers are actually our partners – and we can boast a widespread network of contacts with first class research centres throughout the world.” The academic world is a very important resource for M31: “For us, universities are a pool we fish our collaborators from. Our objective is to work consistently on frontier engineering projects, that is, on the frontier of the state of the art of technological progress. The importance of a widespread network of contacts with universities and access to new technologies and to the latest results of research stem from this ambitious project. We have recently constructed a rolodex, a series of contacts with potential business angels who can intervene and financially support some of the projects we are working on and we also have worthy contacts with early stage venture capitalists.”

The Italian context is radically different from that of the United States especially regarding risk-taking and enterprising. In Italy entrepreneurs have to be much more careful during the start-up phase, more prudent and far-sighted. It is for this reason that M31’s business model envisages a long seed phase for our start-up companies which are incubated as if they were real and proper business offshoots within M31. As the incubation period increases – during which time the product must be defined and a sturdy and sustainable business plan created – the start-up company’s chances of success increase. At the end of the incubation phase the business project can “officially” create the new venture or, on the contrary, the project can be either abandoned or ceded to third parties due to a lack of technical or commercial requisites. The long incubation phase that precedes the establishment of the company can therefore be considered an efficient key for reducing start-up risks. Even the corporate governance of M31 is innovative; in fact it is equally divided between businessmen, researchers and managers, counting about 20 partners. So, here we are not dealing with a classic university spin-off made up of lecturers and researchers who have become businessmen, but a business project shared equally among partners with radically different backgrounds: management, research and business; all working together in the name of innovation and technology.

Among the targets of the first year (nearly all of which have been reached) we highlight: the completion of the core team, quality certification of the procedures, the creation of an investor and business angel rolodex to support M31’s activities, the production and collection of IP and start-up of activities in California and in Great Britain. After only one year’s activity, the company has 17 employees who work alongside consultants to a total of approximately 23 full-time equivalents. After one year of incubation, two start-up companies are also being created as branches of M31, one in the biomedical sector and the other in the field of energy efficiency. “Just recently – Frezza says proudly – we have been joined by an important partner who has purchased 20% of the Company”. In short, M31
is proving to be a very interesting case of a catalyst for businesses and for high technology. It is a project around which some of the best resources in the academic and productive context in the Veneto area are gathering, with a very international slant. An entrepreneurial dream which pools together partners from very different backgrounds with the aim, as Frezza concludes “of building systems and of succeeding in doing so in such a way that the players involved not only play their small part to the best of their ability, but also focus on collaborating with one another in order to obtain success and develop innovation and wealth”.

7. DISCUSSION AND EMPIRICAL EVIDENCE

Two different emergent paradigms of academic entrepreneurship are presented in the previous sections. Let’s compare the two cases. Both academics are two successful and worldwide appreciated researchers: they built a strong international network and they both decided in the central part of their career to start-up an academic spin-off. First of all we consider the entrepreneurial decisional process of Ruggero Frezza and Enrico Pagello. Considering the previous cases and comparing them with the results by Fini et al. (2006) and Wright et al. (2008), Stuart and Ding (2006), it is possible to draw a reference framework for the decisional process. Both professors recognized a technological opportunity. While Pagello is more research oriented and focused on his fields of interest (distributed computing and artificial intelligence and robotics), Ruggero Frezza is ready to explore and support technological paradigms even far from his fields of interest. According to Shane (2004), we can conclude and confirm that the first step of the decisional process is the recognition of the technological opportunity. This latter is not enough to decide whether to start up or not: personal motivations are the main driver of the choice of both academics entrepreneurs. In fact Pagello wants to increase his academic return, while Frezza is strongly guided by the research of high economic returns (according to the serial nature of his entrepreneurial orientation). The role of external factors (incentives and barriers like national and local policies towards academic entrepreneurship, agencies and incubators, technology transfer offices and so on) is therefore marginal in the critical phase of the decision. In fact as we can see reading the cases no one of the interviewed academics recognized a crucial role to these external factors. These considerations can help to describe the complicated metamorphosis of a professor who decides to become part time entrepreneur, clarifying the nature of the nexus (Shane 2004) and presenting it as a rational process. The following figure presents the process of the entrepreneurial critical decision.

![Figure 2](image-url)

Let’s not analyze the motivations of their choices. Case A shows the evolution of a basic consulting experience towards a clear hybrid entrepreneur role. In IT+Robotics research and business sustain each other: one of the main goal of Enrico Pagello is to provide more funds and grants for his staff and junior faculty members. While the expectation of high financial returns foster academic entrepreneurs like Ruggero Frezza to start-up many enterprises the academic reward seems to be one of the main driver of the decision to start-up and to commercialize academic know-how. This result is coherent with the conclusions of Fini et al. (2006): they found that academics’ decision to start-up a new company is much influenced by personal expected outcomes like the possibility to exchange scientific knowledge with outside, to gain prestige and reputation as leading academics, to generate further stimuli for research activities, to create funding opportunities for students or research assistants. The result is also confirmed by Shane (2004) who demonstrated that founding a university spinoff is an effective way to raise money for the development of further technological research.
Case B presents Ruggero Frezza, and his spinoff venture, M31. Ruggero is an hybrid pro-active entrepreneur because of the innovative business model and because of the strong motivations that feed his commitment and entrepreneurial enthusiasm. As far as the author knows no contributions describe the phenomenon called hybrid pro-active entrepreneurship, who thus needs more attention and efforts by scholars. Frezza original business model seems very interesting because he mixes some aspects of traditional business angels and some typical issues of private incubators. Is therefore the entrepreneurial experience of Ruggero Frezza a singular case? What is the long term performance of his firms? Is he an interesting paradigm not only for scholars but even for potential entrepreneurs and investors? These questions are open issues that need to be investigated.

It is clear that in the considered cases risk aversion is quite different. In fact, although both academics maintain their chairs at university (professors are civil servants in the Italian high educational system), the choice of Professor Frezza to start-up many enterprises, trying to support their growth and development, requests a greater propensity to bear risk. The desire of independence and autonomy seems to be a strong motivation for both academic entrepreneurs.

The last point of the discussion about the empirical results is a suggestion, that can be summarized by the following table (Tab.2). Comparing the two cases it is possible to suppose that the intensity of the four motivations can influence the particular model chosen by the potential academic entrepreneur. The predictive power of the table need to be tested in a quantitative way, because the case studies performed in this paper are not enough to set general laws or to demonstrate causal relations. We present it as a future research agenda.

<table>
<thead>
<tr>
<th>model</th>
<th>risk</th>
<th>indipendence</th>
<th>financial return</th>
<th>academic return</th>
</tr>
</thead>
<tbody>
<tr>
<td>the consultant</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>the former academic</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>the hybrid entrepreneur</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>the pro-active entrepreneur</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>Medium</td>
</tr>
</tbody>
</table>

Table 2

8. CONCLUSION

In this paper we presented four models of academic entrepreneurship: the consultant, the full time entrepreneur (former academic), the hybrid entrepreneur (half professor, half businessman), the proactive entrepreneur. While the nature of the first models have already been presented in many contributions: two polar cases present the figures of the hybrid entrepreneur and the proactive entrepreneur. The paper focuses on the critical decision of career shifting, by which academics decide to become entrepreneurs. This decision is explored researching and highlighting the motivations that can be considered as the key drivers of the choice. From this point of view this work is complementary to the works by Fini et al. (2006) and Stuart and Ding (2006) who studied external factors and social mechanisms that influence the decision to start-up or not. The main results of the paper are the following: (i) a clear distinction of motivations and external factors within the entrepreneurial choice, (ii) the presentation of some classical and emergent models of academic entrepreneurs, (iii) the clarification of the “nexus” concept (Shane 2004) within an academic environment, (iv) the creation of some hypothesis to link the intensity of entrepreneurial motivations and the presented paradigms.

This paper is relevant for every potential academic entrepreneur, in order to better understand her/his motivations and to undertake the decision to start-up in a rational way. It is also interesting for the governance system of universities, in order to better understand the behaviours of academics. One of the main conclusion of this work is that before creating a “perfect” ecosystem made of special laws, agencies, incubators and competition in order to foster academic entrepreneurship, our communities need really motivated people who are ready to shift or reformulate their career goals. This result can be achieved only through effective mentoring programs, by fostering the entrepreneurial spirit of students since their first days at university and finally by presenting the right role models to junior and senior faculty members.

The empirical evidence offered by this study can be valuable for managers and venture capitalists who need to understand the organizational and institutional peculiarities of universities in order to properly evaluate the return from collaborations, and joint entrepreneurship (Oakey 2003) and to anticipate the behaviours of their academic business partners (Lacetera 2006). Finally the results can be potentially interesting for other scholars because it offers some testable hypothesis about the relation between entrepreneurial motivations and the business models adopted by academic entrepreneurs.
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