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Combining Theory of Planned Behavior with Triple Helix Model

to analyse Academic Entrepreneurial Intention of young researchers

1. Introduction and synopsis of the central thesis

The theme of academic spin-offs has receiving increasing attention in recent years because of their innovativeness and their contribution to the economic development of local context.

Prior research in academic spin-offs, as the most important means of Technology Transfer from Academia, has focused the attention on the different ways through which they contribute to economic development (Di Gregorio and Shane, 2003; Roberts and Malone, 1996; Roberts, 1991; Shane, 2004; Perez Perez and Sanchez, 2003; Steffens et al., 2000; Mian, 1996). At the same time, great attention has been directed to the investigation of objective and subjective characteristics of academic spin-offs (Roberts and Malone, 1996; Shane, 2004), and to the factors fostering their creation (Di Gregorio and Shane, 2003; Grandi and Grimaldi, 2005).

Little attention has been devoted to the factors and the nature of the process through which academic spin-offs emerge. The authors found only one paper (Prodan and Drnovsek, 2010) that empirically investigates, at an individual level, how entrepreneurial intention, which is the best predictor of new venture creation, emerge among academic subjects.

In our paper, starting from the Theory of Planned Behavior developed by Ajzen (1991), we analyze the main literature on the theme of Entrepreneurial Intention with the objective to develop a model able to explain the emergence process and determinants of entrepreneurial intention among subjects belonging to academic context. Our hypothesis is that Academic Entrepreneurial Intention is a result of *endogenous factors*, concerning the academic subjects themselves and well expressed in the TPB model (Ajzen, 1991) and *exogenous factors* concerning the context in which the subject is involved, well represented in the Triple Helix Model (Etzkowitz, 1993; Etzkowitz and Leydesdorff, 1995).

2. Theoretical Background

2.1 Entrepreneurial Intention and the Theory of Planned Behavior

In the entrepreneurship literature many scholars have focused the attention on the of concept of entrepreneurial intentions (Bird,1988; Krueger et al., 2000). Entrepreneurial intention is defined as a state of mind that direct a person's attention toward a specific goal or path in order to achieving an outcome (Bird, 1988; Bird and Jelinek, 1988). Several contributions show that intention is the best predictors of individual planned behavior particularly when that behavior is rare, hard to observe or involves unpredictable time lags (MacMillan and Katz, 1992). In the context of entrepreneurship, the establishment of new ventures and the creation of new value in existing ones, identified by Bird (1988) as the two outcomes of entrepreneurial intentions, are good examples of such planned behavior. Intention models developed mainly in psychological study, offer a coherent, parsimonious, highly generalizable and robust theoretical framework for understanding and predicting intentions (Krueger et al., 2000). Many model have been developed in order to explain and predict entrepreneurial behavior (Guerrero et al., 2008), but the Theory of Planned Behavior developed by Ajzen (1991) has been proved to be general, robust, more parsimonious and more easily falsifiable than other models (Meeks, 2009). The theory of planned behavior identifies three attitudinal antecedents of intention: attitude toward behavior, subjective norms, perceived behavioral control. With specific reference to spin-off companies the aspect concerning the formation process of an entrepreneurial intention among academic subjects, is a very interesting but yet overlooked research area (Fini et al., 2012; Prodan and Drnovsek, 2010). According to the TPB we can identify the three following constructs acting as antecedents of academic entrepreneurial intention. Attitude toward entrepreneurial behavior, refers to the perception of the individual desirability from subjects belonging to research context, of creating a new venture to exploit results of their research activity. The main obstacle, in this perspective, concerns the change of mentality and role that

is required to a researcher that would assume an entrepreneurial role. The difference lies in the divergent aims and beliefs of researchers and entrepreneurs (Brett et al., 1991) and in the different set of values and rules that characterize the system of public research compared to that of business (Dasgupta and David, 1994). Public research is driven by a sense of curiosity and therefore motivated by a love of problem solving as well as a desire for reputation (Parente et al., 2009). These difference could contribute to the development of a favorable or unfavorable belief about entrepreneurial behavior and then influence the attitude toward it. This favorable or unfavorable attitude is translated in to a stronger or weaker intention to carry out the entrepreneurial behavior. The second antecedent, subjective norms, can be referred to the approval that the academic context in general (other academics, university as institution) and other referent subjects (external firms, financial subjects etc.) have in relation to the entrepreneurial behavior of researchers. A university culture that has not yet fully acknowledged or credited the role of the academic entrepreneur and the inflexibility of rules governing the compatibility of and coexistence between academic and entrepreneurial activities could result in a limited entrepreneurial intention of researchers. The perceived entrepreneurial behavior control, refers to the perception of the difficult to perform the entrepreneurial behavior. Such antecedent is strongly influenced by the confidence in the disposal of ability and competences necessary to perform the entrepreneurial behavior. With specific reference to academic spin-off companies, generally, academics entrepreneurs have a good technical background, but they lack the economic and managerial capability necessary for the creation and development of a new firm. As a consequence, a positive or negative perceived entrepreneurial behavior control is translated in a stronger or weaker entrepreneurial intention.

2.2 The Triple Helix and Entrepreneurial Intention

Entrepreneurship as the creation of a new organization is generally considered as a context-

dependent, social and economic process (Reynolds, 1991). More specifically, the creation of new firm, that is the entrepreneurial event, can be considered as a result of a dynamic interaction between individual and environment (Shane and Venkataraman, 2000). With specific reference to academic firms, the necessary conditions to support the development of academic spin-offs, as a specific form of technology transfer and as a peculiar typology of innovative start-ups, could well be explained following the model of the Triple Helix (Etzkowitz, 1993; Etzkowitz and Leydesdorff, 1995). The Triple Helix model pivots on three helices that intertwine generating a national innovation system: academia/universities, industry and state/government. In the Triple Elix Model, each helices have a specific role to play: Government, at various tiers (supra-national, national and local) has to adopt a set of rules to promote and support innovative start-ups; Universities have to promote policies and instruments to develop the entrepreneurial orientation of their researchers and give support to academic spin-offs; Industry and finance have to provide the necessary resources and competences to start up the firms in a structured manner. Government plays a central role in the creation of the necessary conditions for an effective commercialization of research results. In the last years, the increasing awareness of the important contribution that academic spin-offs can give to economic and technological development, has pushed several countries toward legislative reforms aiming to encourage universities to focus directly on technology commercialization and spin-off activities.

About the second helix of the model, in the last years many universities have promoted policies and instruments aiming to develop the entrepreneurial orientation of their researchers and give support to academic spin-offs. The set of universities support mechanisms is varies, depending on the phase of intervention, the subjects targeted, the type of support provided, the nature and type of resources mobilized and the institutional setting in which they operate (Fini et al., 2011). Industry and finance, or in a more general perspective the business environment within which universities operates, can provide important resources for the establishment and growth of their

spin-off (Fini et al., 2011). First, the level of financial development makes growth and expansion possible, and these effects are particularly relevant for young small firms (Beck et al., 2005; Love, 2003). Venture capital plays a critical role, in both the direct financial support provided by capital investments, and the additional support typically attached to early stage investments. The characteristics of the industries present in the local context can also determine significant business opportunities (Klepper, 2007).

3. Methodology

From the methodological point of view, the conceptual model we develop could be tested through an empirical research on a sample composed of PhD Students of technical faculties in the Campania Region. The path analysis could be realized using the Structural Equation Modeling approach (SEM). In particular, SEM is widely applied in marketing and management studies to predict endogenous latent variables and to validate research hypotheses underpinning latent constructs. One of the most important advantage of such a technique is that SEM enables to measure and specify simultaneously multiple causal relationships between a set of non-observed (latent) variables (commonly defined constructs) and specific observed indicators (commonly defined items). For this reason, SEM can be used to perform a holistic explanation for causal relationship of latent variables in a specific domain problem.

4. Conclusions and Implications

The study aims to develop an integrated model for the analysis of the determinants of academic entrepreneurial intention that lead young researchers to the creation of academic spin-off.

The implications of the paper are twofold: theoretical and managerial.

From the theoretical point of view, the research aims to fill the gap existing in literature about the process through which the Academic Entrepreneurial Intention emerges. The results of the

study will enable the formulation of some conclusions about the necessary conditions to stimulate the development of an entrepreneurial intention among subjects typically involved in research activity and then characterized for interest and behavior totally different from those characterizing the entrepreneurial context. From the managerial point of view, the study could have important implications for university in order to implement actions and strategies aiming to stimulate entrepreneurial orientation of their academics. Finally, research could have implications in the field of entrepreneurship education, in order to develop the orientation of PhD Students toward the entrepreneurial choice as a valid option for their career.

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University-Industry interaction for a sustainable energy system:

The case of smart grid technologies

Introduction

The sustainability challenge that our society is facing associated with the increase of electric demand require a radical transformation of the electric sector. The change of paradigm that is required is toward a Smart Grid, defined as "an electricity network that can intelligently integrate the actions of all users connected to it - generators, consumers and those that do both - in order to efficiently deliver sustainable, economic and secure electricity supplies" (European Technology Platform SmartGrids, 2006). The development process of smart grid paradigm could be investigated from different, yet intertwined, perspectives (i.e. institutional, technological, managerial). In our paper we'll go in depth about the technological perspective, and in particular we will focus on the role of different actors (academic/research institutions and industry sector) involved in the development of smart grid technologies. In this context, the theme of interaction university and industry is, in our opinion, an interesting analysis perspective and it could shed light on the evolution dynamic of related technologies.

Collaboration between universities and industry, aimed at the transfer of technical and scientific knowledge to the economic system, is now considered a crucial factor for the competitiveness and Economic Development (Etzkowitz, Leyde-sdorff 2000; Cooke et al., 2004; Bonaccorsi, Daraio 2007). Starting from the literature that higligthts he role of University-Industry collaborations in the development of new technology and innovation processes, objective of the paper is to analyze the dynamics and determinants of interaction between University and industry in the smart grid technologies sectors. Using data from European Patent Office, we analyze U-I interactions in terms of co-generated patents and test an econometic model to measure the impact on collaborations of the three following

variables: the reputation of academic researchers; the openess of industry; the technological distance between University and Industry.

Our study contributes to the existing literature on university-industry relationship, and could have relevant implications for policy makers and university management in order to adopot adeguate policies aimed to stimulate collaborations to support the emerging paradimg of smart grid energy system.

Theoretical framework

Smart grid: the emerging paradigm in the electric sector

The Smart Grid is a difficult challenge to realize, that requires a global effort: all stakeholders must play a proactive role to achieve the ultimate goal. In particular Smart Grid development requires significant new investments and commitment mainly from the technological point of wiew. Many of technologies needed for smart grid are today available as separate elements and at differente maturiry stage. Further investments in R&D are required with the objective to reach the development level necessary to be used at a large scale. Then, the analysis of the interaction among the two main sources of technological development could, in our opinion shed light on the reasons why the new energy paradigm develops or fails to develop over time.

University Industry Collaborations

There is a general consensus in the literature (e.g. Hamel and Prahalad, 1994) that the development of innovation is strongly related to the organizations' capability to collect and manage knowledge, since its use and combination provide the creativity and the novelty necessary to move outside existing paradigms. In this perspective, the innovation process can be wieved as an open process, where complementary and heterogeneous inputs (pieces of knowledge) are transformed into outputs (results of innovations) (Katz and Khan, 1996).

It is also commonly accepted that universities are important sources of new knowledge, especially in the areas of science and technology (Rosenberg and Nelson, 1994; Nelson and Rosenberg, 1998; Etzkowitz and Leydesdorff, 2000). Other studies show the limited cacapcity of university to translate the excellent results from European research into innovations that are successfully destined for the marketplace (Abramo et al., 2009). Several studies have empirically showed the superior ability of industry actor in the applications of knowledge to economic sector and in the esploitain processes of new knowledges and technologies (Cohen and Levinthal 1989, 1990). Thus, researchers have devoted a great attention to investigate the nature and the importance of the relationships between university and industry, trying to build a clear picture of which mechanisms may favour universities and firms interaction, thus promoting knowledge transfer and acquisition (Etzkowitz, Leyde-sdorff 2000; Cooke et al., 2004; Bonaccorsi, Daraio 2007; Shane 2004; Thursby and Thursby, 2003; Mowery et al., 2001). A better comprehension of university-industry links has assumed a great importance also at policy level, as shown by the several initiative launched by the European Commission to proactively enhance the transfer of technological knowledge from university to industry and identify effective and efficient innovation policies. The importance for both parties, University and Industry has been well documented (Owen-Smith and Powell, 2003) as well as the role of collaboration for both parties ((Meyer-Krahmer and Schmoch, 1998), the differents forms of collaboration (Cohen et al. 2002; D'Este and Patel, 2007; Faulkner 1994) and the factors leading universities and firms to fruitful collaborate (Debackere and Veugelers, 2005; Veugelers and Cassiman, 2005; Rothaermel et al., 2007).

Research methodology

Starting from these premises, the objective of the paper is to analyze the dynamics and determinants of interaction between University and industry in the European Smart Grid

sectors. Using data from European Patent Office, we analyze U-I interactions in terms of co-generated patents between scientific research and industry (Lissoni et al., 2008) and test an econometic model to measure the impact on collaborations of the three following variables: the reputation of academic researchers; the openess of industry; the technological distance between University and Industry. Co-generated patents see university researchers as the inventors and firms as owners of commercial exploitation rights, often representing the outcome of joint research projects. Investigations of university initellectual property have ranged from textual exegesis of matched scientific publication and patents (Myers, 1995) to sophisticated economietric analyses of the total factor productivity of university licensing endeavors (Thursby and Thursby, 2002). There are numerous advantages to the use of patent indicators (Pavitt, 1985; Basberg, 1987; Griliches, 1990; Hall et al., 2005): patent documents contain highly detailed information on content and ownership of patented technology; they cover a broad range of technologies; patent data are 'objective' in the sense that they have been processed and validated by patent examiners; and patent data are publicly available. European patent data are preferred to the more commonly used data from the United States Patent and Trademark Office (USPTO): the cost of patenting is two to five times higher at the EPO than at the USPTO; and the EPO has a 20–30% lower patent-granting rate than the USPTO (Van Pottelsberghe de la Potterie and Francois, 2006; Quillen and Webster, 2001; Jaffe and Lerner, 2004). The use of co-generated patents as a proxy to evaluate innovation is well documented in the literature (Cerrato et. al., 2012; Belderbos et al., 2014; Messeni Petruzzelli et al., 2014). In a second step of the resarch, we investigates the effect of 3 types of factors on the co-generation of patents between research and industry in the european smart grid energy system: the quality of basic research of teachers-inventors measured on the basis of the number of citations for each of them; the degree of open-innovation of firms, measured by the number of collaborations; the technological relatedness. This is evaluated by means of

the degree of overlapping between the organizations' technological bases, in terms of technological fields in which they patent. In particular, in this research the technological similarity is measured using the patent technological class (Jaffe, 1986). Then we test the following hypotesis:

Hp 1: the probability to co-generate a patent is positive linked to the quality of base research.

Hp 2: *the probability to co-generate a patent is positively linked to the degree of openess of firm.*

Hp 3: *the probability to co-generate a patent is positively linked to the technological relatedness between university and firm.*

Conclusions and implications

Even if there is no impact on the incentive to produce knowledge per se, patents may usefully facilitate the commercialization of that knowledge and help to bridge the university-industry divide. Patents may contribute to the effective functioning of the market for ideas (Merges and Nelson, 1990, 1994; Arora et al., 2001; Gans and Stern, 2000), as well as enhance the incentives and efficiency of the process by which academic researchers search and match with potential downstream partners (Kitch, 1977; Jensen and Thursby, 2001; Hellman, 2007).

We believe that our findings will inspire academic scholars and policy makers to further examine the value-creation opportunities of co-patenting and collaboration arrangements. In addition, we trust that our insights will help practitioners to further optimize their collaborative IP strategies with different types of partner.

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