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New approach for development of academic spin-offs

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1. PROBLEM STATEMENT

This article proposes a new approach to the process of development of academic spin-offs. Traditional approaches interpret this process as linear and sequential, consisting of steps and decision points. In this paper, we propose the development of spin-offs as a process of building and mobilization of people, knowledge, culture, information and resource networks. This new approach allows us to understand how entrepreneurs manage the complexity and unpredictability present in the creation of a new business. We use insights from the literature on social networks, the concept of Open Innovation and management of ecosystems and communities, as well as a case study to understand how researchers can convert a technology born in a non-commercial environment, a university, into a new firm.

The literature of the academic spin-offs is increasing lately (O'SHEA *et al.*, 2008; DJORDJE; SOUITARIS, 2008). The spin-offs can be defined as new ventures created for transfer informal or formal academic technology through launching products and services into the market (MUSTAR *et al.*, 2005). This new venture modality calls the interest of the politic and academic communities due the possibility to create wealth from the results of academic research (VOHORA *et al.*, 2004). There is a growing phenomenon around the world to stimulate and encourage scientists, researchers, professors, undergraduates and graduate students to bring the results of their own researches into the market (DIGREGORIO; SHANE; 2003; ETZKOWITZ; SPIVACK, 2001).

The literature has devoted its efforts to understand the parts of the academic entrepreneurship puzzle. Many scholars try to elucidate the instructional environments (SMITH; HO, 2006; ETZKOWITS, 1999), the entrepreneur behavior (ROBERT, 1991), the development of the initial base of resources and capabilities employing the

framework of resources based-view (VOHORA, *et al.*, 2004; AUTIO, 1997), the factors that influence the survival of these firms (NEKAR; SHANE, 2004). However when it comes to the creation and development of an academic spin-off, the literature pays little attention (O'SHEA *et al.*, 2008).

The current research on the creation and development of spin-offs employ the framework and insights from the life cycle to interpret and to understand this process. Since the seminal works of Robert (1991), the authors interpret the creation and development of this new venture as a linear and sequential process, consisting of steps and decision points (ex: SHANE, 2004; GASSE, 2002; ROBERT, 1991). These studies do not consider the impact of unforeseeable uncertainties and complexity (SOMMER; LOCH, 2004) on the development of this firm. In addition, these authors ignore that many academic spin-offs do not become a large firm or the part of spin-off crash and fail in the real world (AUTIO, 1997).

Recent studies tried to build a new vision of this process, redefining the creation of a spin-off as a non-linear and dynamic process (e.g. VOHORA, *et al.*, 2004; AUTIO, 1997). Even these studies are not adequate to understand and describe the impact of unforeseeable uncertainties and complexity on the course of development of a spin-off and the decision-making process. The central problem of the approach proposed by these studies is the utilization of the stage-gate approach for modeling the creation of this kind of firm.

The stage-gate scheme is a usual framework employed to modeling and structuring business processes. The problem of this approach is that it consists in the vision of academics about the management of the creation of a new firm. This approach does not comprehend the practice of creation of a spin-off. In other words, this approach is not enough to represent how the academic entrepreneur develops, under

unforeseeable uncertainty and complexity, the intangible and tangible resources necessities to make possible the transfer of technology from the academic world to the market.

In this context, this papers aims to propose a new vision about how the academic entrepreneurs create and develop a new venture. We utilize the insights from network literature (RAMPERSAD; QUESTER, TROSHANI, 2009) and the concept of actor-network (AKRICH; CALLON; LATOUR, 2002) to conceptualize this process as a process of building and mobilizing a networking of people, decisions, resources, information and knowledge. We employ the case study methodology to understand how the academic entrepreneurs build a complex networking in order to translate the technology developed at the university laboratory into the market. We also utilized the concept of open innovation to understand the inter-organizational dynamic between the new venture and other organizations in the product development process.

To attain the objectives of this work, we structured the paper in four parts. The first is devoted to present our theoretical background. We draw up the spin-off literature, network literature, the concept of actor-networking and open innovation. The second moment is dedicated to explicit the methodological background used in this work. In the third part, we discuss the main results of the empirical field. And in the last part, we show the conclusions, and point out the limitations and further research.

2. THEORETICAL BACKGROUND

2.1. The process of development of academic spin-off

There are different studies dedicated to understand and to model the process of creation and development of academic spin-offs. Roberts (1991) uses the concept and insight from the life cycle of organizations literature to propose a process constituted of

four steps. This author includes from a phase pre-organization phase which the entrepreneurs write the business plan and develop the first product to a phase of maturity and decline of a large firm. Gasse (2002) explores the relationship between the phase of spin-off and physical structures (ex: incubators and technological parks) created to support the development process of a spin-off. Ndonzuau *et al* (2002) suggests four steps for the creation of a spin-off.

Autio (1997) argues that there is a myopia between academics and policymakers about the development of spin-offs. First, a large part of spin-offs rest small firms. And second, this development shows a non-linear behavior due the technical and market uncertainties. Vohora *et al.*, (2004) also highlights the uncertain nature of path of the academics spin-offs in the challenges to explore a radical academic technology. These authors also employ the stage-gate scheme to model and explain the spin-off development. Their approach shows an evolution on the conceptual treatment of this process (MUSTAR *et al.*, 2005), but it does not show how the entrepreneurs develop in practice the tangible e and intangible resources.

2.2- Network innovation

The traditional literature has traditionally focused on the firm (MOORMAN, 1995; COOPER, 1994). More recently, the scholars have begun to pay attention to the relevance of inter-organization cooperation (RINDFLEISCH; MOORNAN, 2003), especially with the emergence of the open innovation paradigm (CHESBROUGH, 2003). The growing clamor for network management is due to the impact of science and technology fields and a variety of players involved (GEELS, 2002), the more complex R&D initiatives, greater are the development costs and time, shorter the product life cycle and more limited the scientific expertise (TUSHMAN, 2004).

Despite the interest for network management, there is not a consensus on the concept of network and whether it can be managed (RAMBERSAD; QUESTER; TROSHANI, 2009). A network can be broadly defined as a set of actors and the relational ties among them (IACOBUCCI, 1996). Some researches believe that networks have no clear boundaries and possess no hub (FORD *et al.*, 2002). Other scholars advocate that sub-networks could have boundaries (GULATI; NITIN; AKBAR, 2001). There is another controversy on whether networks are intentional or emergent (RAMBERSAD; QUESTER; TROSHANI, 2009). The debate on this issue has its background on whether a network can be managed or not. Achrol and Kotler (1999) propose a useful distinction between “network organization” and “network of organization”. The researchers use the concept of network of organizations to address something unmanageable (RITTER, WILKINSON; JONSTON, 2004) and the concept of network organizations is applied to intentional nets. Moller and Rajala (2007) advance this last point and argue that the network is born due to the intentional action of its participant.

In this paper, we will consider that a network can emerge as a result of the intentional action of the entrepreneurs.

2.3. Actor- Network

The actor-network is a concept developed by Akrich, Callon and Lattour (2002). This concept is employed to understand how the actors have succeeded in the process of innovation. According to these researchers, there is a difference between the innovation process and innovation in the making. The process of innovation is an attempt by managers, economists and academics to model and manage innovation. This process does not correspond to innovation in making:

An innovation in the making reveals a multiplicity of heterogeneous and often confused decisions made by a large number of different and often

conflicting groups, decisions which one is unable to decide a priori as to whether they will be crucial or not. (AKRICH;CALLON; LATTOUR, 2002)

The innovation in making is a process of building a network of allies. The innovator is an actor-network that builds a network of allies in order to make the innovation a success.

We will employ this concept to understand how academic entrepreneurs can create an organization to develop, produce and commercialize innovation.

3. CASE STUDY

Voss et al. (2002) argue that case study methodology is particularly useful when the research goal is to propose a new model or a new theory. This is consistent with the research aim, i.e., proposing a new approach for the development of academic spin-offs. In this study, the key variables of how entrepreneurs develop an initial academic spin-offs planning and the relationships between these variables will be understood.

In order to attain the objectives, the paper was structured the field research as follows: i-creating of research protocols and tools; ii-definition of the criteria for definition the potential cases to be investigated; iii- cases selecting; iv-conducting field research; and v- model elaboration.

Voss et al. (2002) reinforce that the validity of results obtained from a case study depends on the rigor of the design of research protocols and tools. In this paper, the protocols were developed from the literature research on spin-offs creation and development, innovation networks and actor network. These protocols corresponded to the key questions that guided the preparation of questionnaires and research roadmaps which were applied in the cases studies. In order to record the information obtained from the field study and from the generated documents, informational framework was built.

Academic spin-offs whose technologies have been explored initially conceived within the university and of which the founders were the researchers who developed the technology were chosen. Moreover, a list of ten potential spin-offs that could be studied was elaborated. For selecting the cases to be investigated, three criteria were considered and analyzed: business relevance, different stages of business development, and different technological bases. The criteria for different stages of business development permitted to follow the whole process of development of spin-off from the beginning.

Only one of the ten spin-offs initially listed met the three criteria. The innovation of this spin-off was an autonomous sensor (a radical innovation at the time). Its market was being formed and the supply chain was fragmented. This spin-off was based in electronics and was developed by four entrepreneurs: a professor, a doctoral student and two master's students. In the case study, semi-structured interviews with people who lead the business planning process were conducted. The SPA I was accompanied for twelve months, which allowed monitoring the business evolution, the issues that arose for its development, the planning processes, among other elements. To this end, all the founders, i.e., 100% of human resources development were interviewed, and a part of the observations was done informally in the research laboratory (The initial seat of the spin-off).

4. RESULTS

4.1- The idea birth to create an academic spin-off

The academic spin-off being analyzed was born in the research laboratory of Electronic Department. After four years of research, the entrepreneur decided to take to the market the academic technology. First, this entrepreneur had to convince another member of the laboratory, a co-developer of the technology. Then, the two entrepreneurs traced a strategy to convince professor X to transfer the technology

through the creation of a spin-off. Initially, the professor demonstrated some resilience. In order to convince this professor, the two entrepreneurs made a presentation on academic entrepreneurship and on the potential of the technology. After some weeks of informal and formal negotiation, the professor was convinced to become a partner of the new venture.

We could observe that the birth of the spin-off consisted in the building of a network. First, the entrepreneur developed arguments to convince his partner of research. And second, the two entrepreneurs planned a set of strategies to convince the leader of the laboratory, their professor. The building of this network involved a process of negotiation, sharing information and knowledge.

4.2. Product development

Initially, the entrepreneurs have had a complex decision to take: which product should they develop. The academic technology has a diversified purpose: multiple possibilities of application in different contexts of market. To help in this process, the professor decided to consult an expert in technology planning of academic spin-offs. This expert was an old colleague and he still teaches in the same university. After some interactions, this expert indicated another researcher to help in the process of selection of the technology application. This researcher was a master student and his research was about the technology planning of an academic spin-off. The expert persuaded the student claiming that it could take the spin-off to conduct a field research.

This student (we will call him X) gave managerial support to the selection process. First, he employed a market research and portfolio techniques to structure and evaluate the technology options. After many interactions, the technological and market uncertainties could not be eliminated. The entrepreneurs reduced the universe of

possibilities to four options. Nevertheless, the entrepreneurs have not been convinced on the four options.

The entrepreneurs decided to make a big bet. They chose an option even without much evidence supporting their choice. The management tools are not enough to cope with the unforeseeable uncertainties and the complexity. After consulting several specialists, the student realized that it was impossible to accurately define the best technological solution. And he decided to give support to the choice of the entrepreneurs.

The entrepreneurs needed financial resources to develop the first prototype of the product. The student X helped them to write a business plan and helped to make the presentations for the venture capitalists. To access these venture capitalists, the entrepreneurs entered the incubator of the university, which had relationships with several private and public partners.

Parallel, the entrepreneurs began to search for the first clients. They appealed to their social network to have access to two clients: a car company and a mining company. For each client, the entrepreneurs had to build a set of social and business relations. They had to explain the potential of the technology and demonstrate potential problems that the technology solved. This process involved a complex process of negotiation and learning. After two months of negotiation and exploration, the mining company commissioned the development of a product.

An internal process of the incubator selected the spin-off to receive financial resources of an investor. With this financial resource the entrepreneurs began to develop the product. The product concept has been changing over the development process. The traditional literature of new product development argues that the product concept must be defined and frozen at the beginning of the process (COOPER, 1994).

The concept was being defined as the network was being built in an unpredictable way. New events, new information and new knowledge emerged, creating opportunities for the product concept that had not been previously contemplated.

The prototypes of the product served as communication tools in the network. The physical evolution of the technology has demonstrated the ability of the entrepreneurs.

The design of production required the construction of relationships that the entrepreneurs did not have before. Entrepreneurs articulated and built a set of social relationships to form a small supply chain to develop and provide the components of the product. Some partnerships were made risks due to the reputation of the teacher.

We could register again that the product development process is also the building of a network. To have access to tangible and intangible resources, entrepreneurs had to build a network of actors. We observe a similar process of development on the production plant and the on the commercialization of the product.

5. CONCLUSIONS

The objective of this article was to propose a new approach for the development of academic spin-offs. The current approaches see this process as a set of stages a decision points, following the structure of a stage-gate process. In this article, we sought to demonstrate that the process of creation of a spin-off follows the process of building a social network. The network's construction has an emergent nature, finding its impulse in intentional acts of the entrepreneurs. The network's evolution follows an unpredictable path, bringing up unpredictable events and information, which could not be mapped previously.

Therefore, the business opportunity is a process of social construction. It takes shape as the network is formed, leading to the development of tangible and intangible resources that the entrepreneurs could not imagine initially. Both entrepreneurship and innovation in practice may be interpreted as a process of construction of a network of allies. More than that, the development of a spin-off consists in a process of construction and mobilization of a network of actors, knowledge, people, culture, and information that allow the tangible and intangible resources to be developed.

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