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Science Parks as Global Entrepreneurship Platforms

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Cities and their Science Parks - Growing local economies

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SCIENCE PARKS AS GLOBAL ENTREPRENEURSHIP PLATFORMS

Executive Summary

As a cluster organization, technology businesses located in a science park benefit from their inter-firm networks, as well as from their connections to university and governmental institutions. We based our project on Triple Helix to develop a model representing the evolution of the relative support of the agents involved in an innovation system in each stage of development. We took into account six born global companies of the La Salle Innovation Park in Barcelona and focused on the analysis of five main tracks determining the business development (technology, talent, finance, location and evolution) in order to internally validate the proposed model. As a result we found that the support provided by these three agents of the innovation system varied from one stage of development to another. The detailed results contribute to improve the effectiveness of the support programs for technology entrepreneurship.

Keywords: born global company, triple helix, technology entrepreneurship, cluster

Innovation-based environments have shown to be especially favorable to create and grow technology ventures. Science parks are an example of those highly innovative frameworks which actively support entrepreneurial behaviours and encourage knowledge creation, knowledge share and opportunity exploitation (Etzkowitz *et al.* 2005).

A science park consists of property-based ventures connected to universities and other research institutions, encouraging the creation and growth of knowledge-based ventures, where there are well-suited facilities available for firms to conduct their business (Monck *et al.*, 1988). A science park is a localized node of knowledge-intensive ventures offering the benefits of being connected to specialized research organizations and specialized customers and suppliers. Apart from formal facilities, the proximity to other knowledge-intensive firms promotes knowledge sharing (e.g. Saxennian, 1994; Sorenson, 2003; Nonaka *et al.*, 2000; Zucker *et al.*, 1998) and thus the creation of new opportunities (Shumpeter, 1942). Besides, it increases the availability of accessible intermediate inputs, allowing firms to take advantage of a more extensive degree of specialization (e.g. Sorenson, 2003; Stuart *et al.*, 2003; Porter, 1998; Marshall, 1920).

Due to the current global economy, many of those new businesses target international markets right from their birth; they "view the world as their market place from the outset and see the domestic market as a support for their international business" (McKinsey & Co., 1993). These firms seek a competitive advantage by using resources from several countries and by selling its products in several countries (McDougall *et al.*, 1994; Oviatt *et al.*, 1994; Oviatt *et al*, 1995; Oviatt *et al.*, 1997). Global entrepreneurs take advantage of the Global IP as a competitive advantage, and gain access to global markets through ways that other people have learned and created.

In spite of the multiple studies developed on the role of science parks as entrepreneurship promoters, there are still not clear evidences of what exactly science parks provide and how they support the new firm development (Fergusson *et al.*, 2004). The goal of this research is to detect the main factors supporting technological entrepreneurship and venture growth in a science park. The analysis will be based on the Triple Helix model as an innovation system

(Etzkowitz *et al.*, 2000): university, government and networks among industries. We are going to carry out a step-by-step analysis while we expect the importance of these three agents as support providers varies from one stage of the business development to another. In fact, the differential approach of this study lies on the separate analysis of each step of the business development model.

We based the analysis on our previous research and field studies in the Bay Area of San Francisco and in the Barcelona Area (see e.g. Etzkowitz *et alt.*, 2006; Piqué *et al.*, 2005; Piqué *et al*, 2004) and on literature review in order to select 5 critical variables determining the global-born-companies' business development process. Afterwards, we defined a model using both, the business development stages and the Triple Helix model. Finally we took into account six born-global-companies linked to La Salle Innovation Park in Barcelona and interviewed the founders in order to validate the proposed model.

The interviews showed that universities, industry and public administration play different roles at each stage of development of a born global company. University and government support is especially important at the first stage of inception and launching. During the subsequent stages of growth and maturity the primary support moves to inter-firm networks.

The results of the analysis contribute to detect the main factors supporting technology start up during each specific stage of business development. Besides, it may also give evidence of the relative importance of the agents as support providers and of how this support operates. As a result, governments and other organizations may be able to help improving the technology entrepreneurship support policies.

The paper is organized as follows. In the first part we define a science park as a cluster organization supporting the creation of born global companies. In the second part we explain the research methodology and define the tracks and business development stages that are going to be deeply analyzed. In the third part, we based our analysis on the Triple Helix to develop the model which shows the evolution of the support and its relative importance at the different business development stages. In the fourth part we present the main results of the six interviews and we analyze and discuss them in the fifth and last part of this article.

SCIENCE PARKS AND TECHNOLOGY ENTREPRENEURSHIP

Over the last two decades many Science Parks and business incubators have been created connected to the most important universities. The growing attention paid to these technology firms nodes is the result of the widespread belief that science parks encourage national and regional development (Malecki, 1991; Shefer *et al.*, 1993), stimulate R&D and innovation in SMEs (Westhead, 1997), promote wealth creation and business profitability (Geroski *et al.*, 1993; Harris *et al.*, 1995) and generate new jobs (Westhead *et al.*, 1995) (in Westhead, 1998).

Monck *et al.* (1988) defined a science park as a property-based-venture co-location which benefits from management functions to support the transfer of technology and business skills to tenant firms, where firms are connected to university or other academic research institutions and which is designed to encourage the formation and growth of knowledge-based firms (Monck *et al.*, 1988). As a cluster organization, a science park is a form of network that occurs within a geographic location, where the proximity of firms and institutions ensures certain forms of commonality and increases the frequency and impact of interactions (Porter, 1998)

The benefits of being located in an innovative environment generate a virtuous circle (Kenney, 2000) attracting entrepreneurs and talented professionals, specialized suppliers and investors from all the world. The localized structure of social networks promotes knowledge flow among all these actors. Several combinations of knowledge give rise to new opportunities (Schumpeter, 1942), and thus individuals working within a cluster can more easily detect gaps in products or services around and build businesses (Sorenson, 2003; Porter, 1998). At the same time, the growing demand of assets, skills, inputs, and staff attracts specialized suppliers, which make it easy for new businesses to gain access to needed resources (Porter, 1998).

Many academics have been focused on studying which factors and how do they support the creation of technology ventures within science parks (e.g. Link *et al.*, 2005; Linderlöf *et al.*, 2003; Etzkowitz, 2002). Others studied the factors promoting the technology ventures' growth (e.g. Siegel *et al.*, 2003; Colombo *et al.*¸2002; Monck *et al*, 1988). In spite of the big scientific value of some of these studies, there are still not clear evidences of exactly what science parks provide and how they support the development of new firms (Fergusson *et al.*, 2004).

In this research we study the environmental factors determining both, creation and growth stages of new technology-based firms in science parks. As other innovation systems and according to the Triple Helix (Etzkowitz *et al.*, 2000), new ventures in a science park benefit from the partnership between academic institutions, government and private sector. Inter-firm networks and their relationships with the universities and the government create a favorable ecosystem for starting up new technology-based firms. We expect that the importance of the factors supporting entrepreneurial activities differ from one stage to another, and thus that it also varies the relative importance of the support providers at each stage of business development.

RESEARCH METHODOLOGY

When a research aims to answer "how" and "why" questions, when the investigators have little control over events, and the focus is posed on a contemporary phenomenon within some real-life context, case studies are the preferred research strategies (Yin, 1984). In his book about *Case Study Research*, Robert Yin (1984) supported that the evidence from multiple-case is often considered more compelling, and that the overall study is therefore regarded as being more robust. As a result, the ability to conduct 6 to 10 case studies, arranged effectively within a multiple-case design, is analogous to the ability to conduct 6 to 10 experiments on related topics.

In our research, we selected six born global ventures created within the La Salle Innovation Park in Barcelona. This science park was created around La Salle – Ramon Llull University in Barcelona in 2001 in order to meet the commitment forged by La Salle with People, Organizations and Society by stimulating and managing the Transfer of Knowledge, Technology, People and Businesses. By 2007, this science park had already supported the creation of more than one hundred technology-based enterprises.

We based out analysis on two widely accepted models. The first one is the general business development model which divides the process into four stages: inception, launch, growth and maturity. The second model is the Triple Helix (Etzkowitz *et al.*, 2000) model defined in a previous section.

Based on these two models, this study aims to analyze how the Triple Helix Agents provide their support within an innovative environment as a science park to the technology venture development at each business development stage. We propose a model which shows the relative importance of the support coming from the three agents of innovation at each stage of business development (figure 1). For a deeper analysis of the behaviour of born global companies and in order to obtain comparable results, we focused on five core tracks of the business development process. The five tracks linking data to propositions are (figure 2):

- T**echnology** or intellectual property, and the characteristics of the R&D.
- T**alent,** meaning among others the educational and professional background of the entrepreneurial team, their global diversity and their organization and roles in the business.
- F**inancial** sources and conditions.
- L**ocation** and connections to technology platforms, as well as the area of influence.
- E**volution** of the value chain, sales, and other market and commercial characteristics.

Figure 1. Business development stages and the analysis of the five core variables

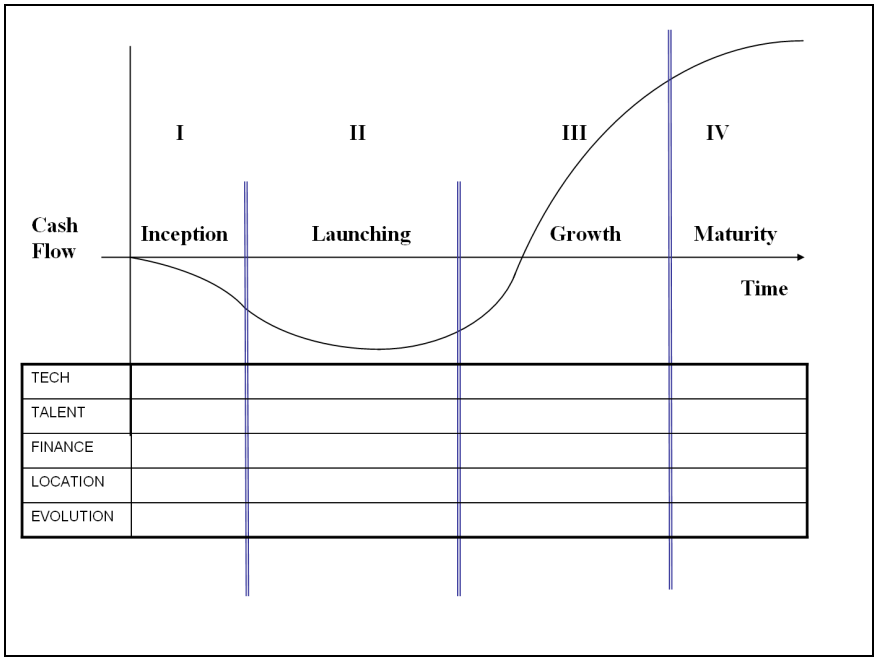


Figure 2. Five tracks linking data to propositions

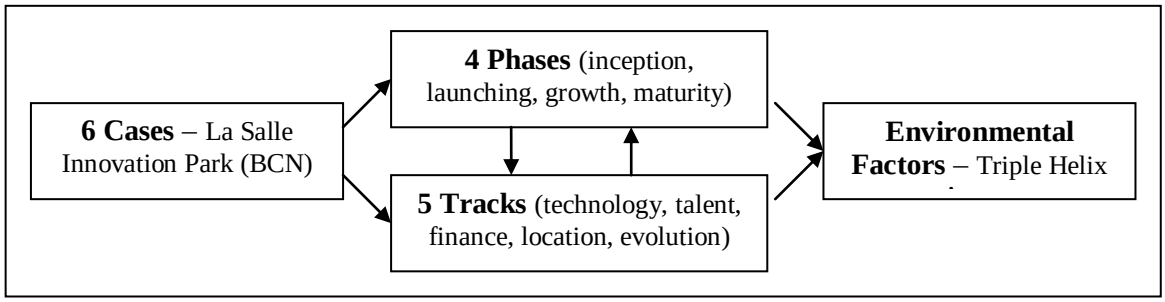
TECHNOLOGY	Research and Development Intellectual Property Right Product and Production Resources
TALENT	Educational and Professional Background Global Diversity, Mentality and Networks Organization of Human Capital and Alignment of Roles and Functions
FINANCE	Sources of Financing (FFF, BA, VC, CV) Conditions (Expectation of return) Domestic and International
LOCATION	Local/Global Space Technology Platforms
EVOLUTION	Value Proposition, Business Model, Business Plan… Local and International Sales Local and Global Costumers Value Chain.

We started the research by checking the literature and proposing a model for linking technology entrepreneurship in science parks and the Triple Helix. Afterwards, we studied the behaviour of the six born global companies with an exploratory purpose. The goal of an exploratory research is to build a theory that provides a solution to a problem presented through the research question, and to internally validate it (Yin, 1984). The external validation requires a further confirmatory research.

The data collection was based on personal meetings with company founders during the months of November and December of 2007. The interviews were aimed to find evidences about 5 tracks at each stage of the business development process: inception, launching, growth and maturity. The six companies were carefully selected to obtain a representative sample of six newly-created and technology-based firms. All of them are, or have been, differently connected to the university or to the government during any of the four development steps and all of them show a global nature as they plan to obtain a significant part of their sales and revenue from international markets.

Starting from the deep analysis of the interviews we identified which factors, when and how they were supporting most of the entrepreneurial process in La Salle Innovation Park. Then, we studied the behaviour of the born-global-companies in order to detect environmental factors supporting technology venture development within an innovation system as a science park. The environment is the unit of analysis which will be characterized by studying the behaviour of the sub-unit of analysis, the born global venture. We analyzed the five tracks at each of the four business development stages in six different technology venture cases in order to draw conclusions about environmental factors determining the development process. We finally connected the conclusions to the three agents included in a Triple Helix innovation system model: the university, the government and the enterprises (figure 3).

Figure 3. Research design



DEVELOPMENT OF THE MODEL UPON THE TRIPLE HELIX BASIS

Etzkowitz and Leydesdorff (2000) defined an innovation model based upon a Triple Helix of university-industry-government interactions. This model was defined on the basis of the *National and Regional Innovation System* models developed by Lundvall (1988), Nelson (1993) and Freeman (1998) among others and the important contribution of Gibbons (1994) and his *Mode 2* model, which explains knowledge production from a multi-disciplined and heterogeneous approach.

The Triple Helix thesis postulates that the interaction among university-industry-government is the key to improve the conditions for innovation in a knowledge-based society. Industry operates in the Triple Helix as the locus of production; government as the source of contractual relations that guarantee stable interaction and exchange; the university as a source of new knowledge and technology, the generative principle of knowledge-based economies. Industry and government have always been major institutions in model society. The Triple Helix raised the university to an equivalent status in a knowledge-based society, unlike previous institutional configurations where it had a secondary status.

Because of its simple structure and robustness, the Triple Helix model has been used as the basis of many studies. In our case, it perfectly fits and explains the case of La Salle Innovation Park in Barcelona, which operates around La Salle – Ramon Llull University and counts on the support of the regional government of Catalonia.

On the basis of the Triple Helix, we analyzed the roles and interrelations of the agents involved in the innovation system. Each agent manages several resources in order to support the creation of born-global new technology-based firms (figure 4). The role and importance of the support of the three agents vary depending on the agents and the stage of development of the technology ventures.

Figure 4. Agents in a Science Park and managed resources

Agents	Resources
- Research University - Government (National, Regional and Local) - Companies (Large, SME)	- People with capabilities and networks - Science and Technology - Knowledge (How to) - Experience(We know) and Vision - Network - Space - Technology Infrastructure. - Professional Services - Market (inside market) - Money - Meeting Points - Customers (like a Golden References)

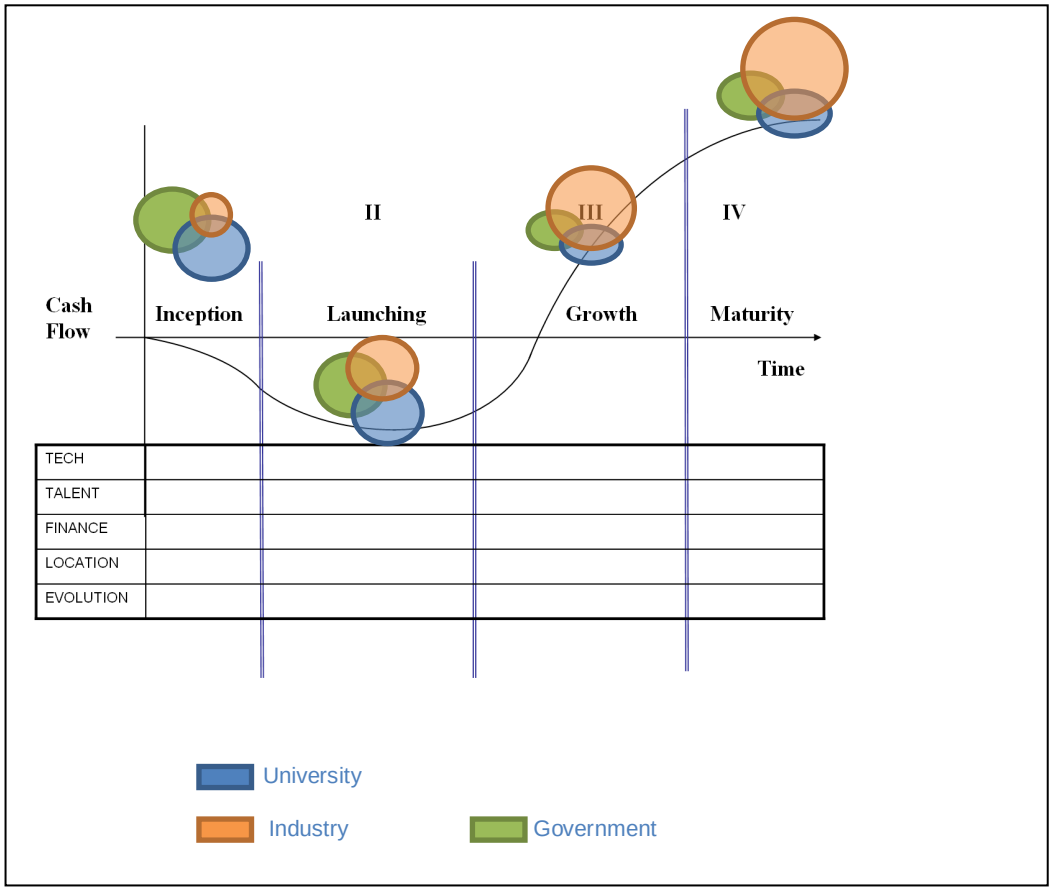
Figure 5 summarizes the main roles that each agent plays. The growing importance of knowledge and the role of the university in incubation of technology-based firms have given it a more prominent place in the institutional field. The entrepreneurial university takes a proactive stance in putting knowledge to use and in broadening the input into the creation of academic knowledge. As firms raise their technological level, they move closer to an academic model, engaging in higher levels of training and sharing their knowledge. The government acts as a public entrepreneur and venture capitalist in addition to its traditional regulatory role in setting the rules of the game. Moving beyond product development, innovation then becomes an endogenous process of "taking the role of the other one", encouraging hybridisation among institutional spheres.

Figure 5. Role of the Agents in a Science Park

University	- Persons with capabilities and networks - Science (Research Centers) - Technology (Technological Centers and licensing) - Knowledge about entrepreneurship (How to) - Experience (We know) and Vision - Network - Space - Technology Infrastructure - Meeting Points - Costumers (like Golden References) - University Angels - Fostering entrepreneurship. The competitions.
Government	- Role of Legal Framework. - It could act like a demand source, providing a sophisticated market for high-tech products and solutions. - Finance Science and Technology through public programmes. - Invest in Education at the Universities.
Industry	- Large Firm: Invest in new companies in order to manage its strategic innovation. Corporate Venturing. - Small and Medium: Network and cluster. - New companies, as the way to put science and technology like a value proposition.

These roles vary at each stage of development, and thus the relative importance of the support provided by the agents fluctuates from one stage of development to another. Figure 6 represents the importance of the support of the three agents at each stage of business development. Due to their research infrastructures and ability to create knowledge and widely skilled workforce, universities play a key role in encouraging the technology venture creation. In most environments, governments invest in research and, in some cases, they finance small technology-based firms. Once the new ventures are created, the importance of the relationship among them grows steadily. At the last stage of development, relationships allow the ventures to share identities, trust and a lot of information about new technological developments.

Figure 6. The relative importance of the agents for supporting the development of technology ventures in science parks



RESULTS OF THE ANALYSIS

The six open-ended interviews with the founders of the companies were done during the months of November and December of 2007. The structured questionnaires became sometimes conversational in order to better understand *how* the three agents of the innovation system provided support and *how* it benefited. The founders were asked about the five tracks (technology, talent, finance, location and evolution) at each of the four business development stages (inception, launching, growth and maturity).

The founders of the companies agreed answering that their previous experiences in other companies motivated them to start up a new business. Most of the commercialized products were based on software technologies and thus the initial steps of the businesses depended on

knowledge and technology development. At that point the technology was still not developed and thus the company was just a business idea. This fact made the access to resources especially difficult, both human and financial resources. In fact, some of them agreed that they "would not have started the company nor have the possibility to grow if they did not receive government aids" of around 100.000€[1].The development of the technology was long and hard, and it required a big amount of resources.

Entrepreneurial teams started with around five technical skilled people. The lack of business experience forced them to be randomly involved in different management tasks, which means that "one person belonged at the same time to the development department, marketing department, and financial department; which is just an approximation to the reality because the company was not departmentally organized. Departments and director positions arose with the time and growth of the company."

Once the prototypes were developed, it started the launching stage, trying to go into the market and get the first customer; some of the companies had already achieved the first customer(s) while others were still developing their technologies. The difficulties faced by the analyzed cases differ from one company to another.

Founders agreed that "government aids are still very important in this stage", they wrote applications for getting them[2]. However, some companies received also private venture capital of around 100.000€-700.000€, which in some cases reached €1.5 million.

This stage "requires a widely skilled management team". The technology skilled team was working on new technology developments and thus the new team had the goal of going into market and getting the first customers.

The next stage for growing the company starts once the first customers are achieved and the first sales are closed. The company moves then from product to production. This is the stage when the ventures showed to be global; all six companies have customers all over the world and they were internationally commercializing their products. For the global commercialization, companies required private money injections covering a range between 1.5 and 5 million of euro.

Regarding technology, all the companies were developing new products for complementing or replacing the current ones. Some of them were also thinking on the possibility of opening new offices in foreign countries, and others were looking for a valuable exit mechanism.

The requirement of management skilled people is extensive to this stage. Start ups hired people with management knowledge, especially in the fields of marketing and sales. In average, the team had grown from around five founders to thirty or more people. Due to the global approach of the company, the team included people from different nationalities.

All the six analyzed companies are still in a growing stage. They are not sure about which the milestone that divides the growing and the maturity stage is. Some agreed that "maturity

[1] The Government in Catalonia has a program known as Capital Concepte which finances up to €100,000 as a participative loan (preferential conditions of the interest rate and return periods)

[2] In this development stage NEOTEC national financing is the most requested one. It provides a maximum of 400.000 € per project.

starts when the company is looking for an exit mechanism", while others asserted that "maturity will be concluded when the company will be sold".

Although it was difficult for founders to guess about the size and the location of their company in the future, they all expected their companies to be globally positioned.

CONCLUSIONS AND DISCUSSION

As a cluster organization, a science park is a form of network that occurs within a geographic location, where the proximity of firms and institutions ensures certain forms of commonality and increases the frequency and impact of interactions (Porter, 1998). In the present study, we analyzed the supporting environmental factors resulting from the interaction of the three agents involved in a science park as a Triple Helix system innovation: the university, the government and industries. Based on the literature, we selected five main tracks (technology, talent, finance, location and evolution) and we analyzed them at each of the four main stages of the business development process (inception, launching, growth and maturity). We expected the relative importance as support agents of the university, the government and the industry network, to vary depending on the stage of business development.

On this basis we defined a model showing that the university and the government provide more support at the first stages of business development, while industry networks have a bigger importance for the growth and during the maturity stage.

We considered six global born companies for developing an exploratory multi-case study which could validate our model. We interviewed the six entrepreneur founders and found evidences to validate our model internally. The importance of the university at the first stages results from the technology development tasks. At the inception stage, the born global companies are focused on developing their technologies, so that they need knowledge, as well as widely skilled engineers. Universities provide both factors, so it provides a big support.

Regarding government, the most important support comes from its financing programs, which have been pointed as a key element for the ignition and launching stages. Prototypes and basic technologies (developed during inception and launching stages) are financed with public funds; private capital becomes more important when the first customers and sales are done (grow stage).

Born global companies in science parks benefit from networks with other industries especially during the last stages of business development. Global market achievements force these enterprises to hire international workforce in a primary stage. This fact attracts other global talent, trained entrepreneurs, with solid academic and professional backgrounds who decide to set up their own technology-based companies. As a result, it is easier and easier to create global companies and to go into global markets.

The results of this study contribute to detect and understand how the agents in an innovation system differently support the business development stages. Governments and other organizations may take these results into account in order to improve and maximize the effectiveness of the support programs.

The interviews internally validate the proposed model. The external validation requires a further confirmatory research which could be developed in a further analysis. Besides, we expect the results to vary from one territory to another. Due to environmental differences, agents act differently in each particular environment. Environmental and social characteristics play a key role for understanding how science parks support the global entrepreneurship.

Due to the importance of the subject, we are going to take this paper as a starting point for a series of researches comparing different innovation environments as global entrepreneurship

support platforms. We expect that comparisons with other innovation environments will give us evidence for identifying the differences and improving the entrepreneurship support programs.

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